NASA Contract Report 158956

(NASA-CR-158956) SEASAT A SATELLITE SCATTEROMETER Final Report (General Electric Co.) 63 p HC A05/MF A01 CSCL 05B

N79-16338

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G3/43 43543

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S. Marsh and J. Borusiewicz

GENERAL ELECTRIC COMPANY
SPACE CENTER
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CONTRACT NO. NAS 1-14173
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INTRODUCTION

SECTION 1

INTRODUCTION

This is the final report for the Seasat A Satellite Scatterometer (SASS) program. It contains the following major sections:

Section	Title
2	Subsystem Engineering
3	Design Development
4	Test Program
5	Ground Support Equipment
6	Software Development
7	Quality Control
8	Documentation Summary

The Subsystem Engineering section reviews and provides summaries for the analyses performed in the early period of the program which formed the basis of the sensor design. A description of the sensor design is provided in Section 3. Section 4 reviews the test program listing all tests performed and the environmental exposure (simulated) for each, as applicable. Ground support equipment designed and built for assembly/integration and field testing is described in Section 5. Section 6 summarizes the software developed during the program and the algorithms/flow diagrams which formed the bases for the software. Section 7 details the significant Quality Control activity, while Section 8 lists all system level documents prepared for sensor evaluation, trouble shooting, and testing.

It has been the intent of this report to indicate results of principal activities during the program and to reference documents necessary to enable search of more specific detail, should they be necessary at some future time.

Personnel responsible for the preparation of this report include:

R. Bianchi - Program Manager

A. Heath - Project Engineer

S. Marsh - Quality Control Engineer

J. Borusiewicz - Manufacturing

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SECTION 2

SUBSYSTEM ENGINEERING

SECTION 2

SUBSYSTEM ENGINEERING

Subsystem Engineering for the SeaSat-A-Satellite Scatterometer (SASS) includes the determination of instrument parameters based on spacecraft orbit consideration as well as all of the interface associated requirements. The interface associated requirements include size, weight, volume, DC power, command/control, spacecraft mounting and the environmental conditions of temperature, pressure, vibration and EMI/RFI.

2.1 INSTRUMENT PARAMETER DETERMINATION

Table 2-1 contains the orbit parameters used in the final instrument design. This table is based on an update of DRL I6, "Instrument Resolution Cell/Link Analyses" by letter from LARC dated September 17, 1976. An asterisk at the right of a parameter indicates that it is a measurable hardware parameter. In addition to the parameters defined in Table 2-1, it was also necessary to determine receiver dynamic range, gain switching points, signal flow analysis, requirements for instrument calibration, instrument timing, operating modes and instrument telemetry. The rationale associated with each of these requirements is described in the following sections.

2.1.1 DOPPLER FILTERS

The Doppler filters' center frequency, noise bandwidth and skirt rejection were determined from the requirement for a 50 Km cross-track spacing and a maximum resolution cell size of 50 Km. The center frequencies are chosen for the 50 Km cross-track spacing and 425 Km between the inner cells of fore and aft antenna beams based on the SeaSat-A orbit at maximum latitude ($\pm 72^{\circ}$). A computer program, furnished by LARC, was used to calculate the Doppler filter noise bandwidths corresponding to the 50 Km resolution cell size. The cell size does not exceed 50 Km except for cells #11 and #12 which are 53.2 Km and 57 Km respectively. The filter rejection bandwidths are based on having maximum return power in all Doppler cells except the one in question, which has minimum return. Returns from adjacent cells must be attenuated to at least 10 dB below returns from the desired cell while all other returns must be attenuated at least 20 dB below the desired return. Tables 3.1-1 and 3.1-2 in the Calibration Data Report (DRL I-23 dated 24 January 1978) contain the Integrated Electronics Assembly Level data on the 15 flight Doppler filters.

2.1.2 RECEIVER DYNAMIC RANGE

The instrument dynamic range was determined for the wideband case up to the crystal Doppler filters and for the narrowband case for the remaining portion of the Scat Processor. In both cases, due to the statistical nature of the return signal, an additional 6.6 dB was included for peaks at the upper end of the range and an additional 8.5 dB was included at the lower end of the range so that non-saturating operation would be obtained in either direction. GE PIR 1J40-JH-055, Revision B delineates the final system level dynamic

Table 2-1. Data Values for Link Calculations

Symbol	Fortran Name	Definition	Worst-Case Value(s)	Nominal Value(s)	
a	A	Antenna Amplitude Ratio	0.55	0.55	
α	ALPHP	S/C Roll Error	$\pm$ 0.5 deg.	0	
θ_i	ANGLES	Incidence Angles for Establishing σ^o Curve	0, 10^o, 20^o, 30^o 40^o, 50^o, 55^o	0, 10^o, 20^o, 30^o 40^o, 50^o, 55^o	
ω	ARGPER	Argument of Periapsis	$90^o \pm 20^o$	90^o	
ASC	ASC	Ascending or Descending Direction of S/C in Orbit	+1 (Asc.) -1 (Desc.)	+1 (Asc.) -1 (Desc.)	
ATT	ATT	Mean Altitude on Spherical Earth	772.807 Km	790.14 Km	
b	B	Ant. Waveguide Dimension	1.4986 Cm	1.4986 Cm	
β	BETAP	S/C Pitch Error	· 0.5 deg.	0	
d	D	Ant. Waveguide Spacing	1.651 Cm	1.651 Cm	
δ	DELT	Angle of Rotation for Squint Removal	1.7 deg.	1.7 deg.	
$f_{D\ell}$	DLFREQ(I)	Lower Bandedge Doppler Frequencies	Table 2-1a	Table 2-1b	*
f_D	DOFREQ(I)	Cell Center Doppler Frequencies	Table 2-1a	Table 2-1b	*
f_{Du}	DUFREQ(I)	Upper Bandedge Doppler Frequencies	Table 2-1a	Table 2-1b	*
ϵ	EPS	Orbit Eccentricity	0.001	0.001	
ϕ_L	FILAT	S/C Latitude	$0^o \pm 20^o \pm 72^o$	0^o	
γ	GAMMP	S/C Yaw Error	0.5 deg.	0	
γ_{NOM}	GAMNOM(I)	Nominal Value of Earth Angle for Each Cell	Table 2-1c	Table 2-1c	
G_o	GGO	Peak Antenna Gain	32.5 dB	32.5 dB	
-	IBEAM	Ant. Beam Number	1, 2	1, 2	
J2	J2	Earth Gravity Harmonic Parameter	1.08263×10^{-3}	1.08263×10^{-3}	
J3	J3	Earth Gravity Harmonic Parameter	-2.5×10^{-6}	-2.5×10^{-6}	
L_a	LA	Atmospheric Loss	-0.4 dB	-0.4 dB	
L_R	LR	Receiver Loss	-2.15 dB	-2.15 dB	*
L_T	LT	Transmitter Loss	-1.8 dB	-1.8 dB	*
R	MRADE	Mean Radius of Earth	6378.14 km	6378.14 km	
μ	MU	Earth Gravitational Constant	3.986005×10^5	3.986005×10^5	

Table 2-1. Data Values for Link Calculations (Cont'd)

Symbol	Fortran Name	Definition	Worst-Case Value(s)	Nominal Value(s)
NF	NF	Noise Figure	5.5 dB	5.5 dB "
α_i	ORBIN	Orbit Inclination	104^o, 108^o	108^o
ϕ_{31}	PHI31	Beam #1 Ant. Azimuth Rotation Angle	-46.2 deg.	-46.2 deg
ϕ_{32}	PHI32	Beam #2 Ant. Azimuth Rotation Angle	-133.8 deg.	-133.8 deg.
ϕ_{33}	PHI33	Beam #3 Ant. Azimuth Rotation Angle	136.2 deg.	136.2 deg.
ϕ 34	PHI34	Beam #4 Ant. Azimuth Rotation Angle	43.8 deg.	43.8 deg.
ϕ	PHII	Narrow Dimension Ant. Beamwidth	0.5 deg.	0.5 deg.
ψ	PSI	Ant. Phase Taper	28 deg.	28 deg.
P_t	PT	Transmitter Power	100 W.	110 W. *
σ o	SIGMAS	σ^o Values at 0^o, 10^o, 30^o, 40^o, 50^o, 55^o	Table 2-1d	Table 2-1d
σ^o	SIGNOT	σ^o Values at 8^o, 4^o, 0^o	5, 6, 7 dB	5, 6, 7 dB
W/S	SPEED	Windspeed	4, 12, 24 m/s	4, 12, 24 m/s
C	SPEEDL	Speed of Light	2.997925×10^5 km/sec.	2.997925×10^5 km/sec.
T_a	TA	Antenna Temperature	200^oK	200^oK
T_p	TAUP	Transmit Pulse Length	4.8 ms	4.8 ms *
T_g	TG(I)	Range Gate Length of Cell	Table 2-1a	Table 2-1b *
θ_p	THETAP	Antenna Pointing Angle	40.0^o	40.0^o
θ_s	THETAS	90^o - Ant. Squint	88 deg. $\pm .36^o$	88 deg.
T_N	TN	Noise Integration Time	0.42 sec.	0.48 sec. *
T_p	TP	Ant. Sample Time	1.890399 sec.	1.890399 sec. *
T	TPP	Pulse Repetition Period	29.537 msec.	29.537 msec. *
V_e	VE	Earth Equatorial Velocity	0.4651013 km/sec.	0.4651013 km/sec.
f_t	XFREQ	Transmit Frequency	14.59927×10^9 Hz	14.59927×10^9 Hz *
f_l	FL	Earth Flatness	3.367×10^{-3}	3.367×10^{-3}

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* Measurable hardware parameter

Table 2-1a. Worst-Case Doppler Frequencies* and Range Gate Times

Cell No.	Lower Freq. (Hz)	Center Freq. (Hz)	Upper Freq. (Hz)	Range Gate (ms)
1	169,866	182,315	194,262	7.0
2	206,388	217,497	228,104	7.2
3	239,175	248,969	258,299	7.4
4	268,352	276,800	284,844	7.6
5	294,078	301,206	307,996	7.8
6	316,573	322,485	328,125	8.1
7	336,016	340,972	345,716	8.4
8	352,982	357,004	360,866	8.8
9	367,591	370,901	374,089	9.2
10	380,335	382,952	385,475	9.8
11	391,109	393,415	395.621	10.4
12	400,476	402,514	404,438	11.2
13	52,356	64,660	76,754	5.4
14	20,140	32,392	44,536	5.4
15	-12,198	0	12,198	5.3

*Before addition of 417 Hz due to LO offset.

Table 2-1b. Nominal Doppler Frequencies* and Range Gate Times

Cell No.	Lower Freq. (Hz)	Center Freq. (Hz)	Upper Freq. (Hz)	Range Gate (ms)
1	169,224	182,315	194,904	6.00
2	205,816	217,497	228,676	6.20
3	238,672	248,969	258,802	6.35
4	267,918	276,800	285,278	6.57
5	293,712	301,206	308,362	6.82
6	316,269	322,485	328,429	7.11
7	335,761	340,972	345,971	7.45
8	352,774	357,004	361.074	7.83
9	367,420	370,901	374,260	8.27
10	380,200	382,952	385,610	8.78
11	390,990	393,415	395,740	9.41
12	400,372	402,514	404,542	10.16
13	51,716	64,660	77,396	5.42
14	19,498	32,392	45,178	5.35
15	-12,840	0	12,840	5.29

*Before addition of 417 Hz due to LO offset.

Table 2-1c. Nominal Earth Angles for Each Cell

Cell No.	Gamma (deg.)
1	2.70
2	3.34
3	3.97
4	4.61
5	5.25
6	5.89
7	6.52
8	7.16
9	7.80
10	8.44
11	9.08
12	9.72
13	0.898
14	0.447
15	0.06

Table 2-1d. σ^{o} Values Versus Incidence Angle

Incidence Angle (deg.)	σ^{o} (dB) 4 m/s-w/s	12 m/s-w/s	24 m/s-w/s
0	12.0	9.4	8.4
10	5.0	5.0	5.0
20	- 9.0	- 5.0	- 2.0
30	-21.0	-12.0	- 6.0
40	-24.0	-15.0	- 9.0
50	-27.0	-18.0	-12.0
55	-28.0	-19.0	-13.0

range requirements. The minimum average power spectral density (PSD) based on a 1350^{o}K receiver noise temperature is -197.3 dBW/Hz while the maximum average power spectral density, (cell #4) is -172.1 dBW/Hz.

The overall instrument dynamic range must also include the gain or loss associated with manufacturing tolerances of each receiver component as well as temperature sensitive gain or losses. Table 2-2 is a total system summary of the receiver dynamic range.

Table 2-2. System Summary of Receiver Dynamic Range

Description	dB
P_{SD} maximum - P_{SD} minimum	25.2
Instantaneous Peaks	6.6
Instantaneous Valleys	8.5
Δ Noise BW Cell #4 - Cell #12	6.2
Tolerances + Temperature Variations Below Nominal	4.35
Tolerances + Temperature Variations Above Nominal	4.4
Total System Dynamic Range	55.25

2.1.3 GAIN SWITCHING POINTS

The gain switching design in the 15 channel Scat Processor is such that the gain of each channel is selected completely independent of the signal returns in the adjacent cells or any of the other cells. The analysis, delineated in PIR 1J40-JH-074, "Gain Switching Philosophy of SASS Scat Processor," shows that a detector with 30.1 dB dynamic range and four gain stages, separated by a nominal 10 dB, is more than adequate to cover the entire system level dynamic range. Because of this capability, the gain of each channel was set to approximately the same level when tuned with a CW signal at the corresponding doppler filter center frequency. The gain is selected for each channel by looking at the first three return pulses, one at a time, and stepping in a nominal 10 dB attenuation each time the preset threshold is exceeded. The threshold is the same for all 15 channels because the same A/D converter is used and simply time multiplexed.

The threshold is set for 4.785 volts or 490 counts at the integrator output to allow for the 6.6 dB expected peak excursions without compressing the signal.

2.1.4 SIGNAL FLOW ANALYSIS

The GE "SIGFLOW" program was used to verify that uncompressed processing would be achieved in all channels for all levels of noise, return signal and calibrate signal. This program calculates the effect of circuit elements on a signal. The common inputs to the program include the number of elements, input noise power density, average input signal power, and peak input signal power. The program input parameters required for each element are noise bandwidth, gain or loss, limiting point and element noise figure. This analysis was done for seven combinations of noise, signal and calibrate levels for cells #1, #4, and #12 to cover the widest noise bandwidth, the highest return signal and the narrowest bandwidth respecitvely. PIR 1J40-JH-241 contains the complete analysis including the computer printouts for the seven cases and [illegible] of the integrator outputs for the three cells listed above.

2.1.5 INSTRUMENT CALIBRATION

The "on-board" calibration of the SeaSat Scatterometer is somewhat more complex than it appears at first glance. Since a scatterometer is simply an instrument that accurately measures the attenuation incurred between the transmit and receive signals, it appears that the instrument could be calibrated by directing the transmit signal through a known attenuation into the receiver. The problem associated with this approach is that the transmit signal is pulsed CW whereas the received signal is basically doppler shifted white noise. Because of this difference, it was necessary to calibrate the transmitter and receiver independently. In addition, because of the differences in noise bandwidth and gain step settings, each of the receivers 15 channels had to be calibrated independently.

It was assumed early in the instrument design. and verified more recently during spacecraft level thermal vacuum tests. that receiver gain changes are a function of the instrument temperature and that temperature excursions. being a function of orbit position and season. happen very slowly. The steepest gain versus temperature slope was associated with the Low Noise Amplifier which was subsequently thermally controlled at approximately $35.6^{\circ}C$ to minimize dynamic gain shifts. A frequency of calibration of once every four minutes, or 25 times per orbit was selected for the receiver since receiver calibration precludes the normal data-taking operation. For the transmitter, however, a transmit power measurement is made every 1.89 second period since it does not affect data taking.

Due to the natures of the transmitter and receiver signals, the Scatterometer is calibrated using a diode detector plus integrator and a broadband white-noise generator respectively. A "Complete Receiver Calibration Cycle" consists of four consecutive 1.89 second calibration measurements. Each calibration measurement is done with an order of timing that is identical to the normal operation timing, but is for four (4) different combinations of calibration noise level, HI = $29,000^{\circ}K$ and LO 4 $290^{\circ}K$, and Local Oscillator Frequency, 191.65708 MHz (FORE) and 208.32292 MHz (AFT).

Component temperatures of the Transmit Power Monitor (Directional Detector), Calibration Noise Source and Antenna Switching Matrix are measured and telemetered every 15.12 seconds. These temperatures are used in the look-up tables and algorithms for transmit power (P_T) and receive power (P_R) respectively.

2.1.6 INSTRUMENT TIMING

The two fundamental timing sequences considered in the design of the SASS were the XMIT/REC subcycle period and the Data Accumulation Period. The XMIT/REC subcycle period is associated with the transmit pulse width, signal plus noise integration time and noise only integration time. The transmit pulse width timing and the noise only integration timing are essentially the same for all channels whereas the signal plus noise timing is tailored for each of the 15 channels. DRL Item I-10 (paragraph 6.0) describes the trade-off analysis for the Restrictive Range Gate versus Widened Range Gate Integration and PIR 1JL6-JH-333, Revision A, describes all of the SASS internal control signals associated with one XMIT/REC Subcycle period.

The Data Accumulation Period was defined such that "quasi-contiguous" coverage at 50 Km spacing would be obtained with "Fore" and "Aft" looks in each of the 15 cells based on a perfect orbit and non-rotating earth. Analyses and plots were done by LARC personnel to determine cell overlap for nominal and worst case conditions.

2.1.7 OPERATING MODES (Table 2-3)

The SeaSat-A-Scatterometer has ten operating modes consisting of eight transmitting modes, one receiver calibration mode and one standby mode. The SASS operating modes table provides the cross reference for the mode number, the spacecraft command number, the Scatterometer Electronics Package (SEP) port sequence, the antenna sequence and the footprint/polarization definitions.

Table 2-3. SASS Operating Modes

MODE NUMBER	SPACECRAFT COMMAND NO.	SEP PORT SEQUENCE				ANTENNA SEQUENCE				FOOTPRINT/POLARIZATION SEQUENCE			
1	0003A/B	4	8	2	6	4V	1V	3V	2V	V LF	V RF	V LA	V RA
2	0004A/B	3	7	1	5	4H	1H	3H	2H	H LF	H RF	H LA	H RA
3	0005A/B	4	3	2	1	4V	4H	3V	3H	V LF	H LF	V LA	H LA
4	0006A/B	8	7	6	5	1V	1H	2V	2H	V RF	H RF	V RA	H RA
5	0007A/B	4	4	2	2	4V	4V	3V	3V	V LF	V LF	V LA	V LA
6	0013A/B	8	8	6	6	1V	1V	2V	2V	V RF	V RF	V RA	V RA
7	0014A/B	3	3	1	1	4H	4H	3H	3H	H LF	H LF	H LA	H LA
8	0015A/B	7	7	5	5	1H	1H	2H	2H	H RF	H RF	H RA	H RA
9	0021A/B	4	4	2	2	4V	4V	3V	3V	-	-	-	-
10	0023A/B	4	4	2	2	4V	4V	3V	3V	-	-	-	-
SASS ENABLE	0036A/B	4	4	2	2	4V	4V	3V	3V	-	-	-	-
HVPS ENABLE	0024A/B	4	4	2	2	4V	4V	3V	3V	-	-	-	-
SASS OFF	0033A/B	-	-	-	-	-	-	-	-	-	-	-	-

LEGEND: V = VERTICAL
H = HORIZONTAL
L = LEFT
R = RIGHT
F = FORE
A = AFT

The supplemental table (Table 2-4) provides additional cross references including the AESC antenna serial number.

Table 2-4. SASS Operating Modes Supplemental Table

LMSC Ant. No.	AESC S/N*	SEP Port No.	Footprint/Polarization Definition
1	A2	7 8	HRF VRF
2	A5	5 6	HRA VRA
3	A4	1 2	HLA VLA
4	A3	3 4	HLF VLF

*Reference: LARC letter dated 10-14-77.

2.1.8 INSTRUMENT TELEMETRY

The telemetry data associated with the SASS instrument is either in Bi-level or A/D converted analog voltages. SASS-DRL-114, "Measurement List and Data Format," dated 8 October 1977, Revision D, contains the details of the Data Stream.

In general, the SASS telemetry is categorized as shown below.

- Bi-Level (Status) including Synch pattern, gain bits, SLO frequency selected, calibration status, circulator status, mode selected and analog temperature monitor subcommutator identification bits.

- Bi-Level (Fault Determination) including input current, body current and undervoltage trips, receiver protect circulator status as well as SLO and SMIT phaselock loop indicators.

- Analog Housekeeping (Instrument Health) including internal voltages, currents, RF powers, component and baseplate temperatures, as well as the forty SASS antenna temperatures.

2.2 SASS INSTRUMENT INTERFACE

Three categories of SASS instrument/spacecraft interfaces are described in this report. They are the mechanical, electrical and environmental parameters associated with the SASS design. Paragraph 4.0 includes the Environmental Interface Parameters while the mechanical and electrical interfaces are described in this section. The Lockheed document LMSC-D490728, "Interface Control Document" contains the details of the mutually agreed upon interface.

2.2.1 SASS MECHANICAL INTERFACES

1. Size: GE Drawing (Figure 2-1), 47D235021 shows the outline and mounting points for the SASS instrument.

2. Weight: 59.42 Kg

3. Center of Gravity: $\bar{X}$ = 23.368 cm
   $\bar{Y}$ = 7.620 cm
   $\bar{Z}$ = 53.594 cm

4. Moments of Inertia: I_{XX} = 5.786 $Kg\text{-}m^2$
   I_{YY} = 6.780 $Kg\text{-}m^2$
   I_{ZZ} = 2.076 $Kg\text{-}m^2$

2.2.2 SASS ELECTRICAL INTERFACES

1. Electrical Power Interface: The voltages, currents and power delineated in Table 2-5 are the worst case values measured over the baseplate temperature range of 0°C to +35°C for any SASS transmitting mode.

Table 2-5. SASS Operating Mode 1-8

Bus Voltage (Volts)	Current		Power	
	Amps (avg)	Amps (pk)	Watts (avg)	Watts (pk)
27.7 reg.	2.70	2.70	74.79	74.79
28.0 reg.	2.70	2.70	75.60	75.60
28.3 reg.	2.60	2.60	73.58	73.58
24.0 unreg.	2.42	11.00	58.08	264.00
28.0 unreg.	2.10	9.00	58.80	252.00
32.0 unreg.	1.78	8.50	56.96	272.0

Table 2-6 contains the worst case values measured over the baseplate temperature range of 0°C to +35°C for each of the SASS non-transmitting modes.

Table 2-6. Worst Case Values

Mode	Reg Bus. Volts	Reg Bus. Amps	Reg Bus. Watts	Unreg Bus. Volts	Unreg Bus. Amps	Unreg Bus. Watts	P_{Total} Watts
SASS "OFF"	28.0	0.457	12.8(1)	28.0	0.0386	1.08(2)	13.88
SASS "CONTINOUS CAL (MODE 9)	27.7 28.0 28.3	2.70 2.66 2.60	74.79 74.48 73.58	24.0 28.0 32.0	0.35 0.30 0.29	8.40 8.40 9.28	80.4 81.2 81.7
SASS "STBY" (MODE 10)	27.7 28.0 28.3	2.70 2.66 2.60	74.79 74.48 73.58	24.0 28.0 32.0	0.07 0.10 0.11	1.68 2.80 3.52	76.5 77.3 77.1

(1) LNA Thermal Control
(2) Unreg. bus. inrush current control

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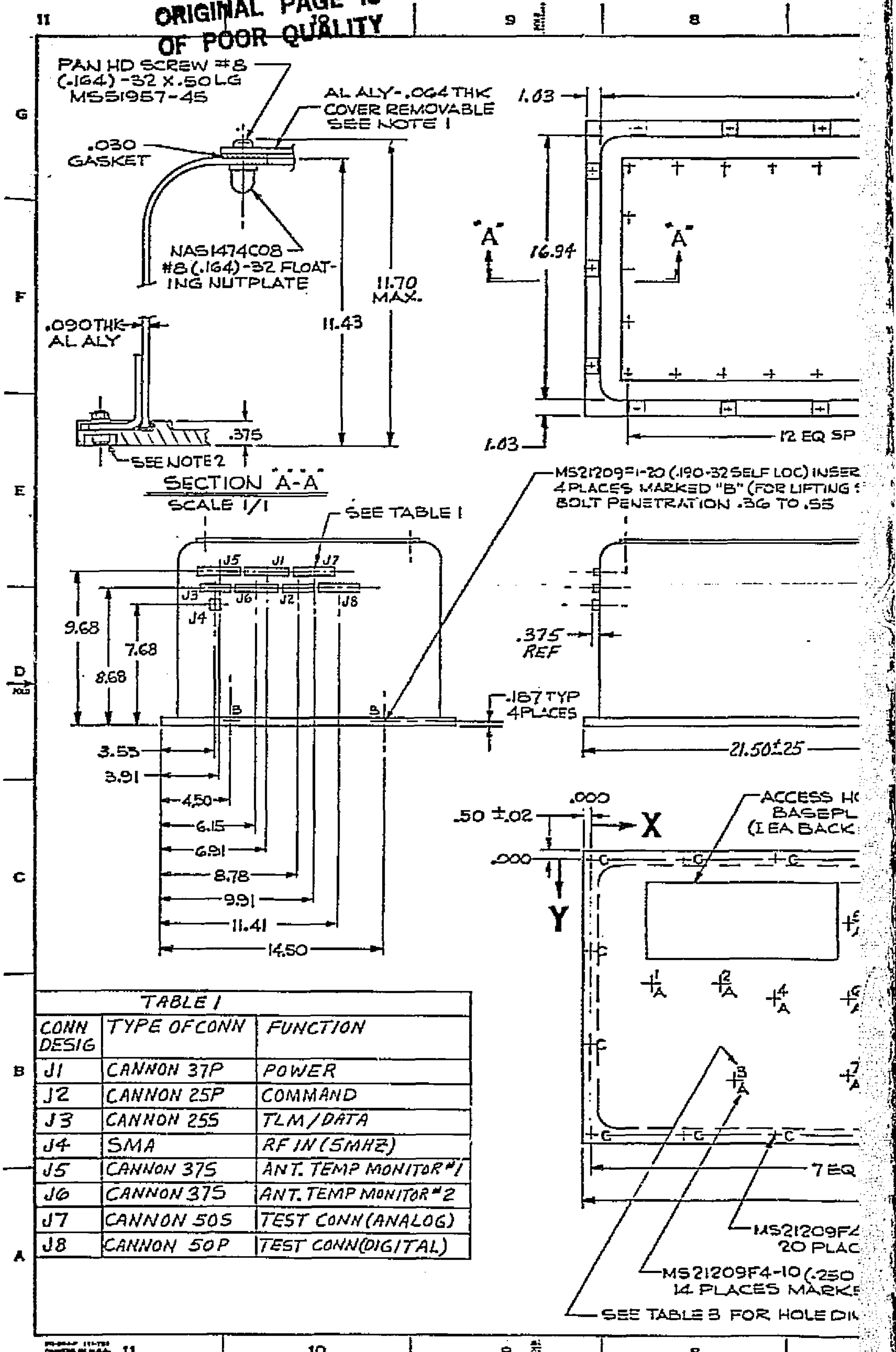
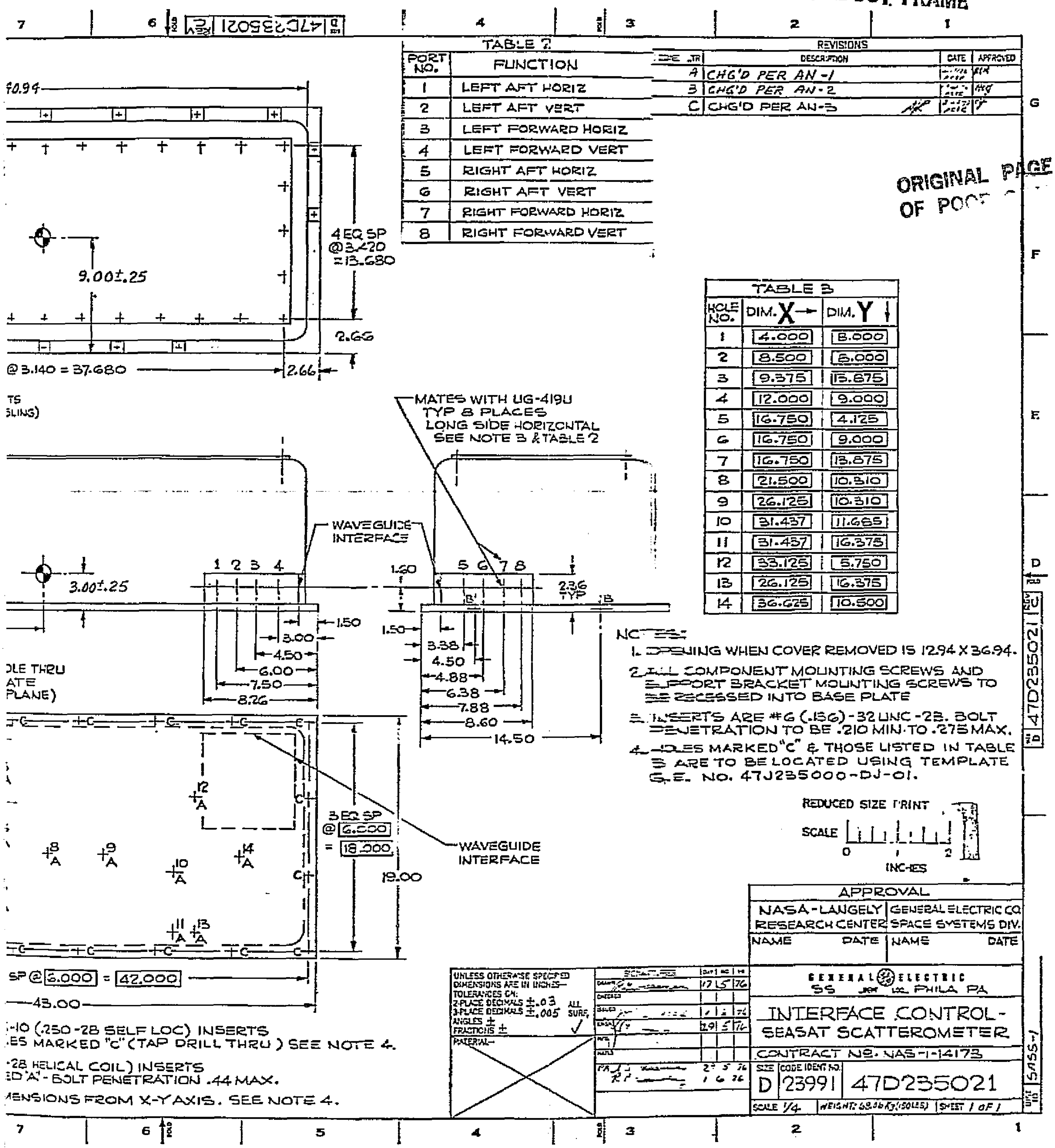


TABLE I

CONN DESIG	TYPE OF CONN	FUNCTION
J1	CANNON 37P	POWER
J2	CANNON 25P	COMMAND
J3	CANNON 25S	TLM/DATA
J4	SMA	RF IN (5MHZ)
J5	CANNON 37S	ANT. TEMP MONITOR #1
J6	CANNON 37S	ANT. TEMP MONITOR #2
J7	CANNON 50S	TEST CONN (ANALOG)
J8	CANNON 50P	TEST CONN (DIGITAL)



LTR	DESCRIPTION
A	CHG'D PER AN-1
B	CHG'D PER AN-2
C	CHG'D PER AN-3

TABLE 2

PORT NO.	FUNCTION
1	LEFT AFT HORIZ
2	LEFT AFT VERT
3	LEFT FORWARD HORIZ
4	LEFT FORWARD VERT
5	RIGHT AFT HORIZ
6	RIGHT AFT VERT
7	RIGHT FORWARD HORIZ
8	RIGHT FORWARD VERT

TABLE 3

HOLE NO.	DIM. X	DIM. Y
1	4.000	8.000
2	8.500	6.000
3	9.375	15.875
4	12.000	9.000
5	16.750	4.125
6	16.750	9.000
7	16.750	15.875
8	21.500	10.310
9	26.125	10.310
10	31.437	11.665
11	31.437	16.375
12	33.125	5.750
13	26.125	16.375
14	36.625	10.500

Figure 2-1. Interface Control – Seasat Scatterometer

2. Command and Control Interface: The two basic command functions associated with the SASS are the Power Control Commands and the Mode Select Commands. The power control commands are activated by an 18 to 32 volt pulse with a duration of 100 $\pm$ 5 milliseconds.

These commands are for SASS "ENABLE", HVPS "ENABLE" and SASS "OFF" as well as for each of their respective redundant commands.

The mode select commands are activated by a momentary closure of a DPDT non-latching relay having a closure duration of at least 10 milliseconds.

Table 2-7 delineates the SASS discrete commands including the spacecraft command number, the command title, and the command description. All SASS associated spacecraft commands and their parameter ID's are included for completeness.

3. Microwave, RF and Digital Interfaces: The microwave, RF and digital interfaces are associated with the SASS transmitter, the spacecraft reference clock and the SASS data stream respectively.

The requirements for the microwave interface are:

Frequency:	2920 X spacecraft clock frequency
Transmit Power:	+48.5 dBm minimum
Pulse Width:	4.8 msec
Repetition Rate:	33.86 PPS
Load VSWR:	≤ 1.2:1
Waveguide:	WR62 (RG-349/U)
Mounting Hole Pattern:	Compatible with UG-1666/U Choke Flange

The requirements for the RF interface are as follows:

Frequency:	4.999750 MHz $\pm$ 0.5 Hz
Frequency Stability:	3×10^{-11} Short Term Stability (500 msec)
RF Power:	0 dBm $\pm$ 1 dB
Load VSWR:	≤ 1.2:1 (50 ohm)
Source VSWR:	≤ 1.5:1 (50 ohm)
Additive Phase: Noise	-125 dBc per Hz @ 1 KHz -125 dBc per Hz @ 10 KHz -133 dBc per Hz @ 100 KHz to 1 MHz from carrier
Coax Cable:	50 ohm
Connector Type:	SMA

The requirements for the digital interface are as follows:

Clock Rate:	156.242 KHz
Bits per Word:	10
Words per Burst:	82
Length of Burst:	7.910 msec (nominal), 9.7 msec (maximum)

Table 2-7. SASS Discrete Commands

Spacecraft Command No.	Command Title	Command Description	Parameter ID
0036 A/B	SASS ENABLE	Power SASS DC/DC Converter	-
0024 A/B	HVPS ENABLE	Power SASS HVPS	-
0033 A/B	SASS OFF	Remove Power from SASS	-
0003 A/B	Op. Mode 1	Meas. Seq. VLF, VRF, VLA, VRA	SS700
0004 A/B	Op. Mode 2	Meas. Seq. HLF, HRF, HLA, HRA	SS701
0005 A/B	Op. Mode 3	Meas. Seq. VLF, HLF, VLA, HLA	SS702
0006 A/B	Op. Mode 4	Meas. Seq. VRF, HRF, VRA, HRA	SS703
0007 A/B	Op. Mode 5	Meas. Seq. VLF, VLF, VLA, VLA	SS704
0013 A/B	Op. Mode 6	Meas. Seq. VRF, VRF, VRA, VRA	SS705
0014 A/B	Op. Mode 7	Meas. Seq. HLF, HLF, HLA, HLA	SS706
0015 A/B	Op. Mode 8	Meas. Seq. HRF, HRF, HRA, HRA	SS707
0021 A/B	Op. Mode 9 (Continuous Cal)	Meas. Seq. VLF, VLF, VLA, VLA	SS708
0023 A/B	Op. Mode 10 (SASS STBY)	Meas. Seq. VLF, VLF, VLA, VLA	SS709
0035 A/B	SASS SELECT Conv. No. 4	Regulated 28 ± 0.3 VDC SASS REG Voltage TLM SASS Total Current TLM	LC539 LC117 LC135
0044 A/B	SASS SELECT Conv. No. 3	Regulated 28 ± 0.3 VDC SASS REG Voltage TLM SASS Total Current TLM	LC538 LC117 LC135
0032 A/B	SASS SELECT PWR ON #1	Unregulated 28 ± 4.0 VDC SASS UNREG Voltage TLM SASS Total Current TLM	 LC101 LC135
0074 A/B	SASS SELECT PWR ON #2	Unregulated 28 ± 4.0 VDC SASS UNREG Voltage TLM SASS Total Current TLM	 LC101 LC135
0451 A/B	SASS Antennas 1 and 3 Deploy	CMD PYRO Firing to Deploy Antennas 1 and 3 Antenna No. 1 TLM Antenna No. 3 TLM	 LA108 LA110
0462 A/B	SASS Antennas 2 and 3 Deploy	CMD PYRO Firing to Deploy Antennas 2 and 4 Antenna No. 2 TLM Antenna No. 4 TLM	 LA109 LA111
-	-	Baseplate No. 1 TEMP. TLM	LA121
-	-	Baseplate No. 2 TEMP. TLM	LA122

Burst Repetition Rate: 1.890399 sec $\pm$ RF Clock Drift

Maximum of Bits/Burst: 820

2.3 SASS INSTRUMENT PECULIARITIES AND CONSTRAINTS

The peculiarities and constraints listed below were excerpted from a LARC letter dated 27 April 1978.

2.3.1 SASS OPERATIONAL PECULIARITIES

1. With respect to self calibration,

   a. Mode 9 is a free running "Continuous Calibrate" operating mode.

   b. One full calibrate cycle, lasting 7.56 sec., occurs after each mode execution before becoming operational in that mode.

   c. One full calibrate cycle occurs periodically every 4 minutes after a mode execution.

   d. Due to the mode execution logic design, a 9.45 sec. CAL cycle (5 CALS) may occur following a mode execution. The probability of occurrence is 1/20.

   e. During a CAL such as in b or c, SASS engineering parameters take on the same values as given for Mode 9 in Attachment 1.

2. At SASS ENABLE, trip indicators SS762, 763, and 764 indicate TRIP and will reset only on execution of the first mode command.

3. At HVPS ENABLE, Under Voltage Trip, SS763, indicates TRIP and will reset only on execution of the next mode command.

4. After HVPS ENABLE, a 3 minute automatic time out to allow TWT filament warm-up begins. The first mode command (Modes 1-8) after completion of the time out turns the transmitter on.

5. The first mode command (Modes 1-9) after the 3 minute time out causes the Input Current Trip, SS762, to indicate TRIP. A second mode command must follow to reset SS762 and make it useful while the transmitter is on. The same applies to excecution of Modes 1-9 after STANDBY.

6. In Modes 9 and 10, the antenna port switching and logic as monitored on SS711, 712, and 713 is the same as in Mode 5.

7. L.O. Power, SS772, is approximately the same for the high L.O. frequency and the Low L.O. frequency but the monitor, SS772, reads quite differently due to calibration differences and accuracy limitations. POCC processing will use the low L.O. frequency curve only and IDPS will use both; hence, the IDPS data will be more accurate than POCC data, but the low frequency L.O. power will still read approximately 1.5 dB higher than the high frequency L.O. power.

8. Transmitted Power, SS761, is approximately 1.5 percent low on the last data frame before a CAL cycle and approximately 5 watts on the last CAL frame.

9. TWT Cathode Voltage, SS765, has a large y-intercept in its calibration and reads -7.86 kv for 0 counts in the POCC processing and display.

10. SASS Input Current, LC135, is a peak current monitor and will typically read between 2.4A and 9.2A in random fashion.

11. Differences in SASS electrical status versus mode as monitored in engineering housekeeping data are defined in Attachment 1.

2.3.2 SASS OPERATIONAL CONSTRAINTS

1. The SASS shall not be turned on unless the baseplate temperatures LA 121 and 122 are between $-10^{\circ}C$ and $+55^{\circ}C$.

2. Regulated 28V from converter #3 or #4 must be applied to the SASS at least 30 minutes prior to operation within specification.

3. It must be verified that no alarms have been exceeded prior to execution of HVPS ENABLE.

4. Two mode commands are required at turn on and after STANDBY.

5. Continuous time in STANDBY or between SASS ENABLE and the first mode command must be $<$ 4 hours.

6. SASS off should be sent prior to switching converters 3 and 4 or sending SASS ENABLE to initialize SASS relays and limit inrush current.

7. All SASS commands must be sent $>$ 2 seconds apart.

8. STANDBY must be sent prior to SASS OFF.

Attachment 1. SASS Engineering Versus Mode

Parameter		Nominal Value		
		Modes 1-8	Mode 9	Standby
SS781	+5V	+5V		
SS782	+15V	+15V		
SS783	-15V	-15V		
SS785	-6V	-6V		
SS786	+6V	+6V		
SS787	Therm. Ref. 1	+5V		
SS788	Therm. Ref. 2	+5V		
SS772	L.O. Power	11.5/13.5 dBm		
SS773	Mod. Power	21 dBm		
SS774	Xmit Drive	16.5 dBm		
SS775	Upcnv. Bias	0.1V		
SS776	TDA Stage 1 Bias	0.135V		
SS777	TDA Stage 2 Bias	0.155V		
SS778	TDA Stage 3 Bias	0.15V		
SS765	TWT Cathod Voltage	8.02 Kv	8.02 Kv	0 Kv
SS766	TWT Cathod Current	57 ma	0 ma	0 ma
SS767	TWT Body Current	5.8 ma	0 ma	0 ma
SS768	Ion Pump Current	0 μA	0 μA	0 μA
SS769	HVPS Input Current	2.57 A	0.9 A	0.7 A
SS862	TWT Filament Current	1.53 A	1.53 A	1.53 A
LC135	SASS Input Current	9.2 A Peak	2.7 A	1.8 A
SS761	Transmit Power	100 Watts	0 Watts	0 Watts

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SECTION 3

DESIGN DEVELOPMENT

SECTION 3
DESIGN DEVELOPMENT

3.1 DESIGN DEVELOPMENT (ELECTRICAL)

The complete SASS Electronics Package (SEP) is shown in block diagram form in Figure 3-1 (GE 47E235099). The instrument package component and subassembly layout is shown in Figure 3-2 (GE 47J235000). Table 3-1 is included as a convenient cross-reference to the SEP layout. The table includes the component/subassembly item number, the GE drawing number, a description, and the GE SVS specification where applicable.

The descriptions that follow include only the design modifications to the SASS baseline associated with the top level assembly operation.

3.1.1 RADIO FREQUENCY INTERFERENCE FILTER

It was found during RFI coupling analyses that a potential interference problem existed between the SeaSat A Altimeter and Scatterometer (SASS). The interferences investigated included the 14.59927 GHz $\pm$ 1 MHz components of the chirpped altimeter pulse based on a SINX/X curve and the effect of the fundamental alti-chirpped frequency of 13.49932 GHz $\pm$ 160 MHz. Calculations showed an adequate margin for the SINX/X component of the chirpped pulse at the Scatterometer center frequency. Calculations also showed a potential SASS LNA saturation problem at the fundamental altimeter chirpped frequency. It was, therefore, necessary to add a RFI filter to the SASS receiver prior to the LNA. The filter added had the following operating characteristics:

Insertion Loss:	0.35 dB maximum at 14.6 $\pm$ .025 GHz
Rejection:	40 dB minimum at 14.18 GHz 80 dB minimum at 13.685 GHz
Passband Ripple:	0.1 dB maximum
Equiripple Bandwidth:	100 MHz minimum, 350 MHz maximum
VSWR (either Port):	1.2:1 maximum at 14.6 $\pm$ .025 GHz

3.1.2 LOW NOISE AMPLIFIER HEATER

There were two temperature related problems associated with the Low Noise Amplifier. The first problem was the out-of-spec gain variation over the $0^{o}C$ to $+35^{o}C$ operating temperature range. The second problem resulted from an apparent hysteresis in that the amplifier gain at any particular temperature was dependent on the temperature and operating time at the previous point.

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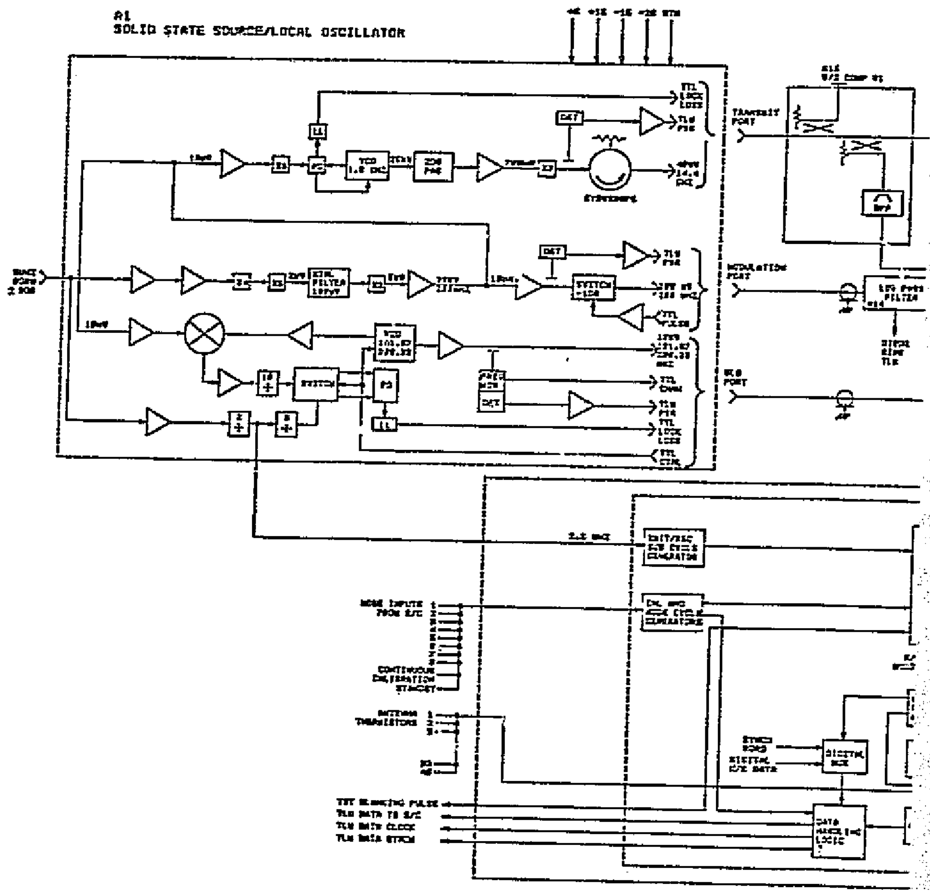

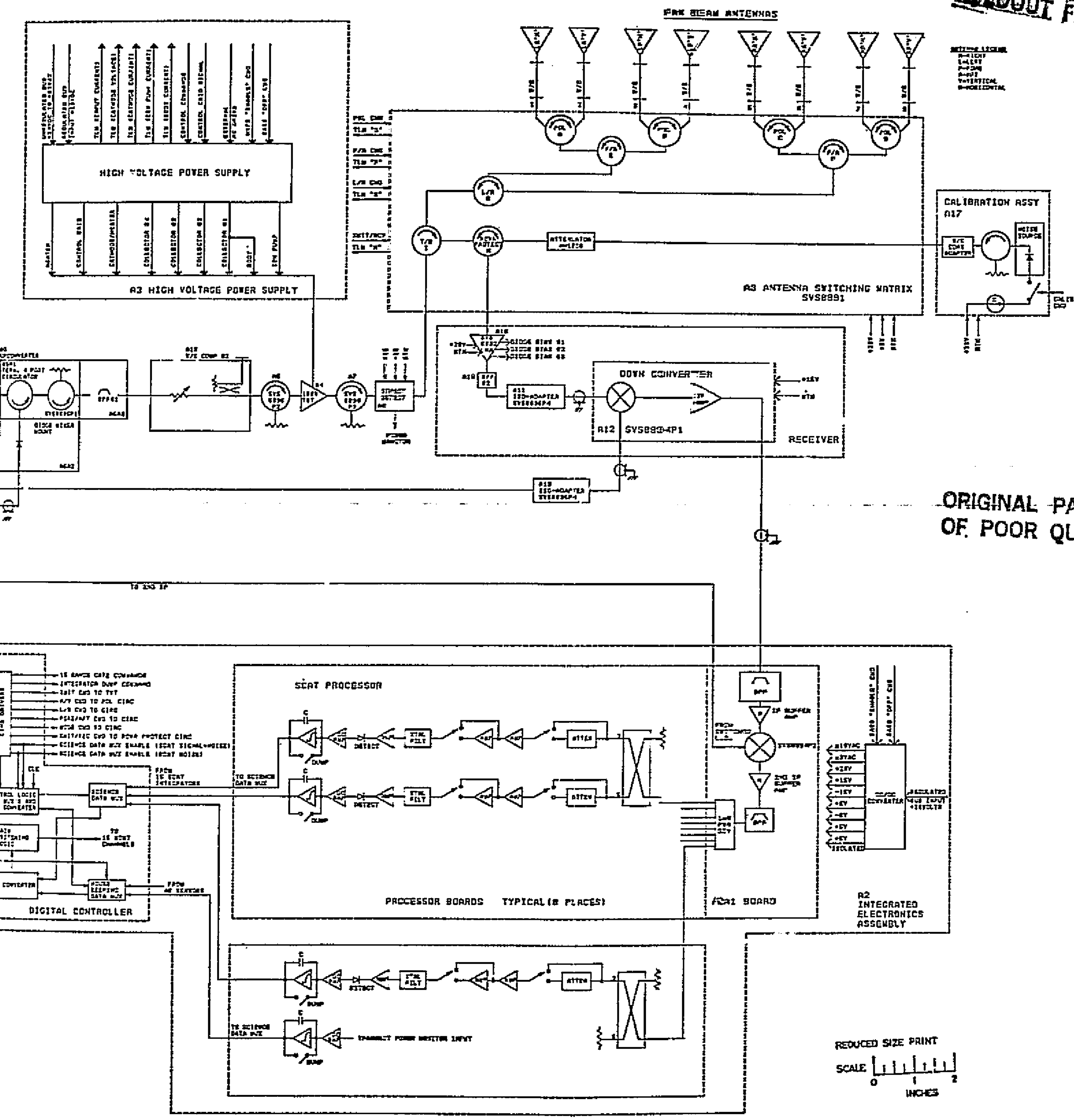

Figure 3-1. Block Diagram
Seasat A Satellite Scatterometer (SASS)

NOTES CONTINUED:

24. STAKE TUNING SCREWS IN A5, A18, AND A19 WITH ITEM 32 PER ITEM 33

25. DISCARD HARDWARE SUPPLIED WITH ITEM 25

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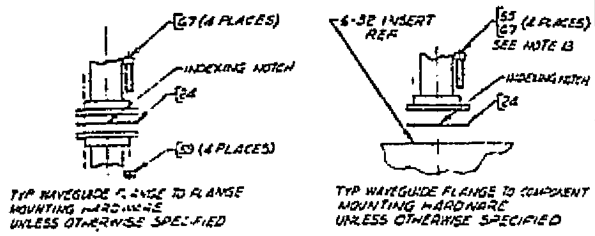
CONNECTOR TABLE		
CONNECTOR DES	MATES WITH	[illegible]
P1	A1J1	ITEM 4
P2	A1J2	4
P3	A2A6J1	6
P4	A2A7J1	6
P5	A2A7J3	6
P6	A2A8J1	6
P7	A2A3J[illegible]	4
P8	A2A9J1	4
P9	A2A9J2	6
P10	A2A9J3	7
P11	A3J1	4
P12	A3J2	4
P13	A3J3	3
P14	A9J1	4
P15	A9J2	5
P16	A11A2J1	ITEM 4



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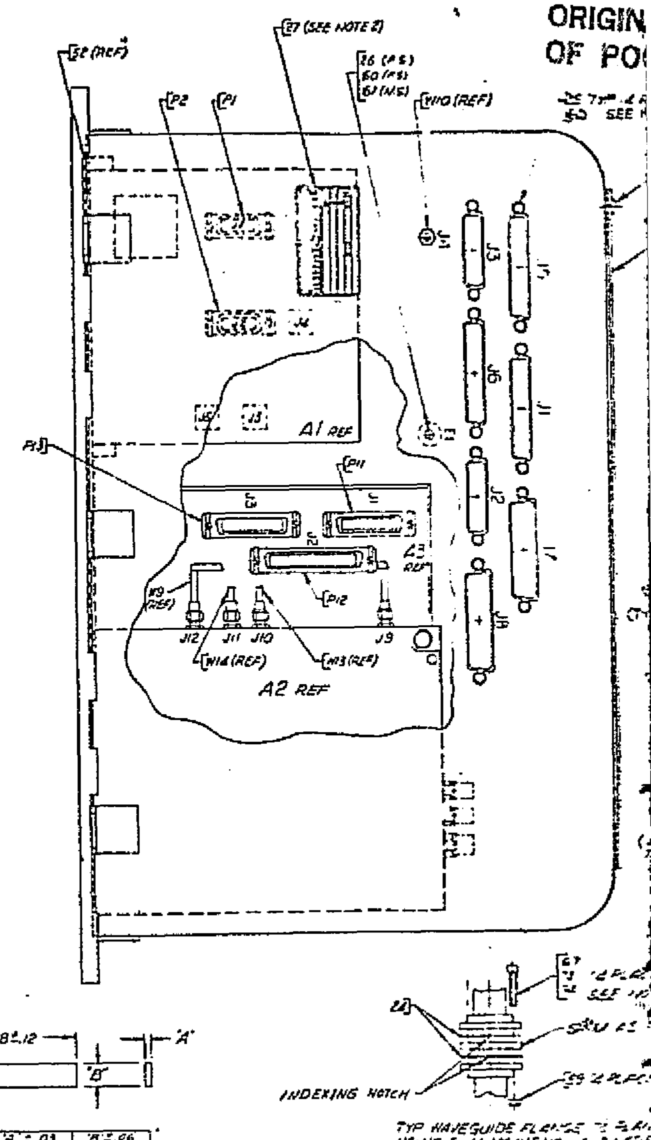

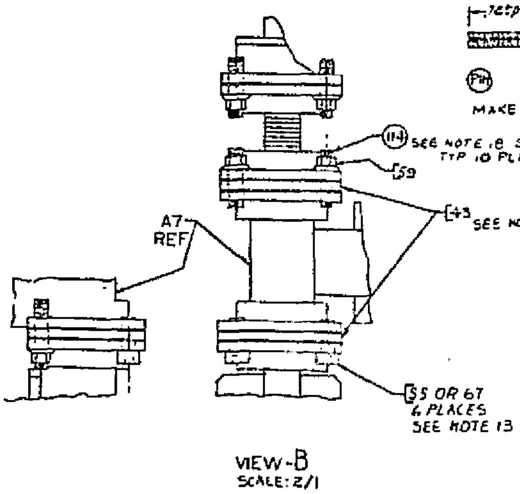

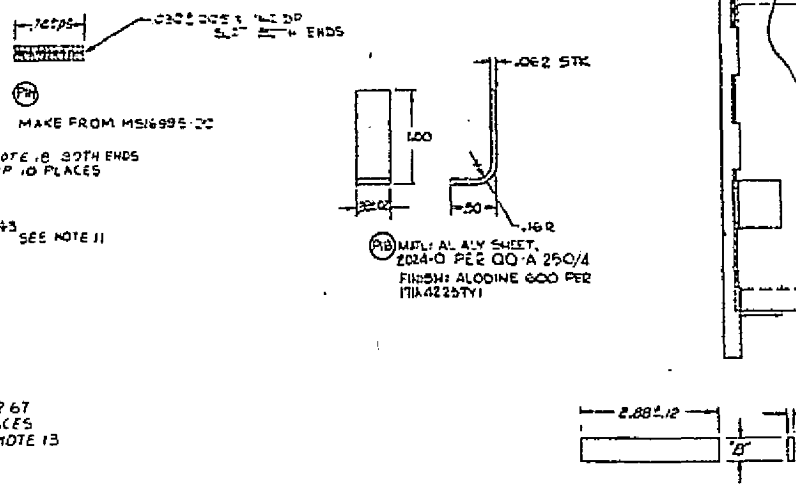

PART NO	"A" ±.03	"B" ±.06
P86	.12	.50
P89	1.26	.75

47J235G[illegible]

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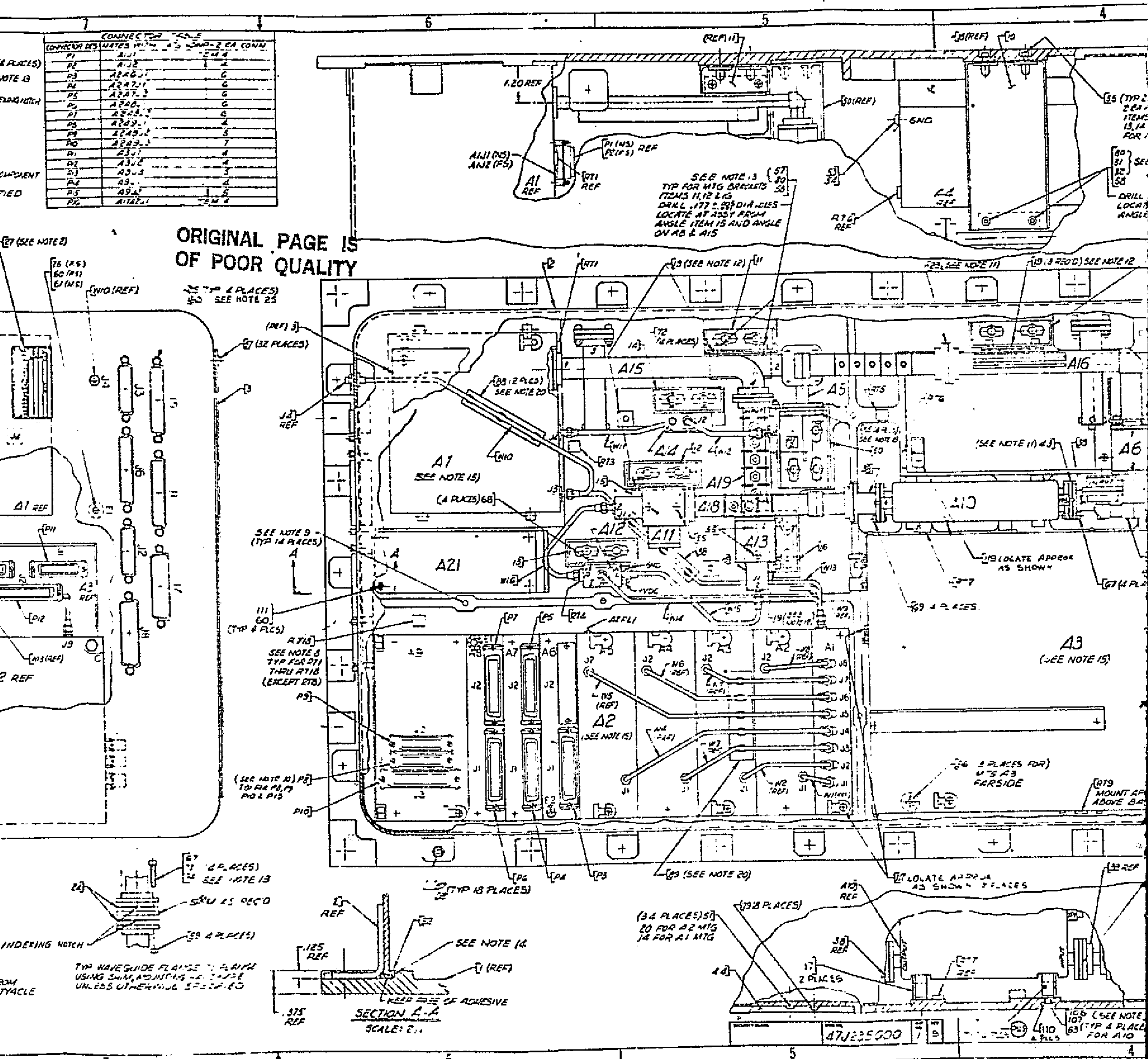

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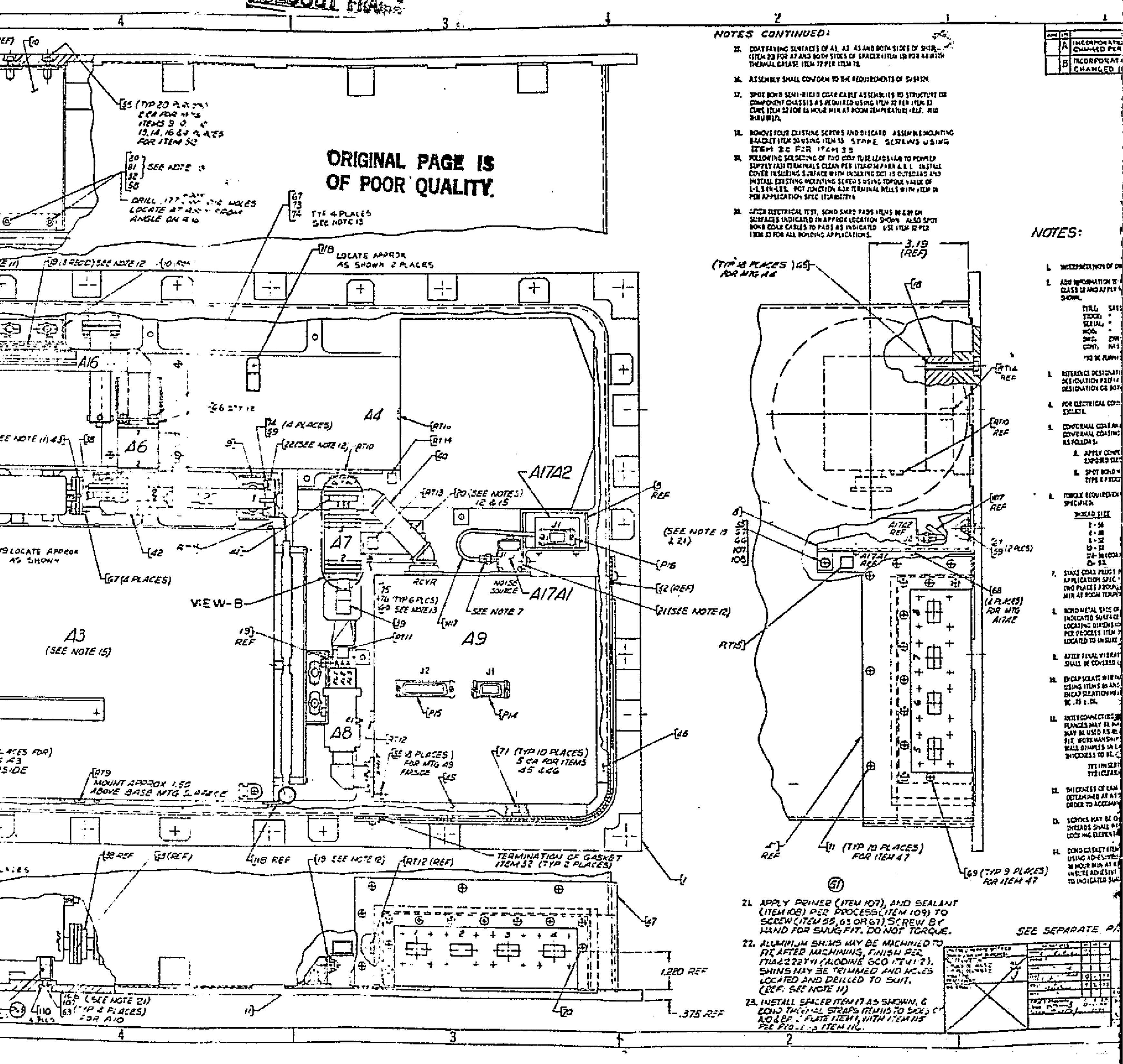

Figure 3-2. SASS In

4

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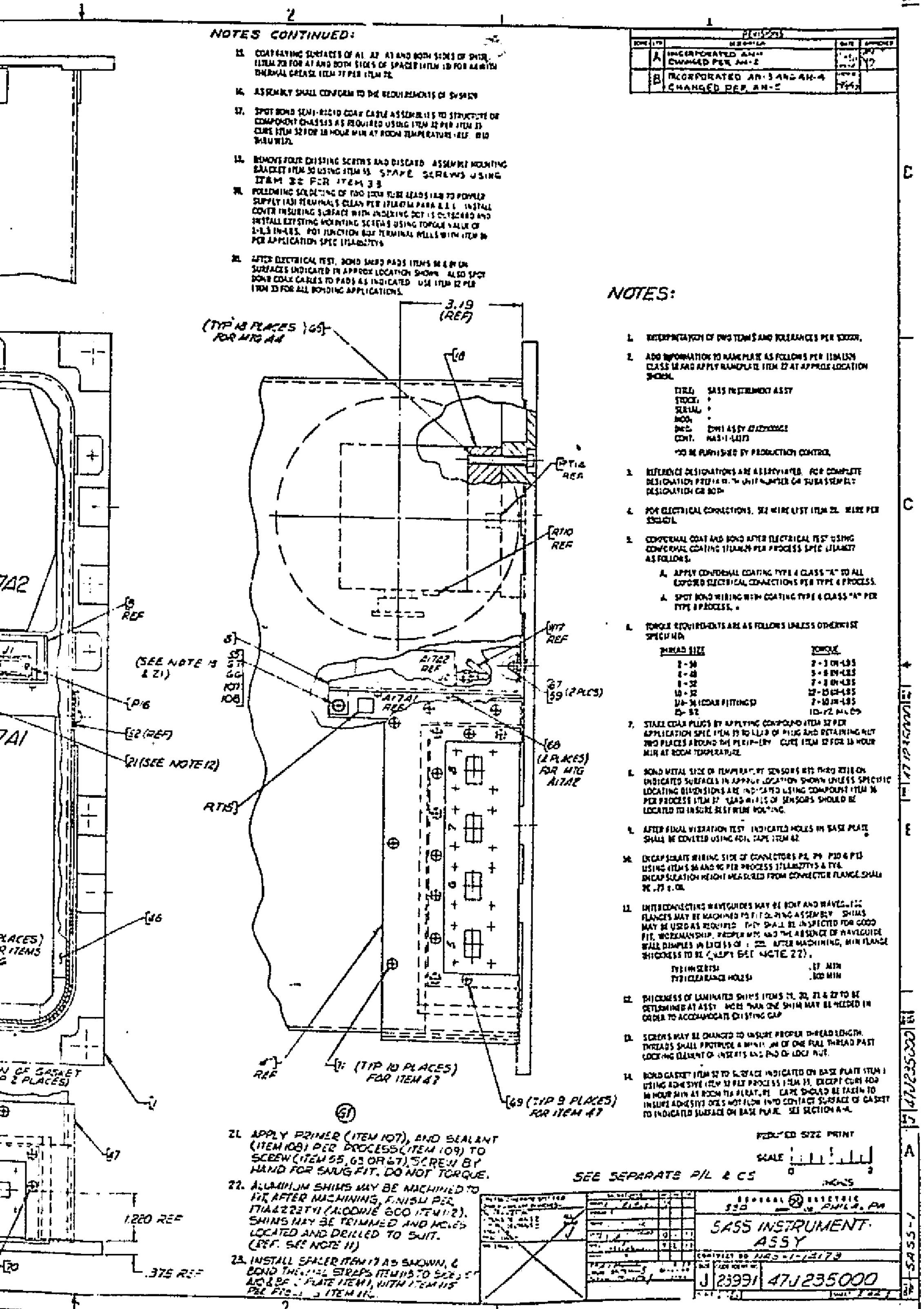

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Figure 3-2. SASS Instrument Assembly

Table 3-1. Cross-Reference to the SEP Layout

Item No.	GE Dwg. No.	Description	Specification
A1	47D235460P1	Solid State Source/Local Oscillator	SVS 8890
A2	47E235250G1	Integrated Electronics Assembly	N/A
A3	47E235100G2	High Voltage Power Suppl	N/A
A4	47D235458P1	Traveling Wave Tube	GFE
A5	47D235026G1	Upconverter	N/A
A6	47C235451P1	TWT Input Isolator	SVS 8896 P2
A7	47C235452P1	TWT Output Isolator	SVS 8896 P3
A8	47D235028G1	Directional Detector	N/A
A9	47E235457P1	Antenna Switching Matrix	SVS 8891
A10	47D235057G1	Tunnel Diode Amplifier	SVS 8892
A11	47C235453P1	ISO Adapter	SVS 8896 P4
A12	47C235455P1	Down Converter	SVS 8894 P1
A13	47C235453P1	ISO Adapter	SVS 8896 P4
A14	47D235027G1	Low Pass Filter	N/A
A15	47C235023G1	Waveguide Assembly No. 1	N/A
A16	47C235024G1	Waveguide Assembly No. 2	N/A
A17A1	47C235462P1	Noise Source	SVS 9035
A17A2	47D235033G1	Noise Diode Power Supply	N/A
A18	47D235095G1	Bandpass Filter No. 2	N/A
A19	47C235072G1	Bandpass Filter No. 3	N/A
A20	47D235461P1	RFI Filter	N/A
A21	47C235059G1	Thermal Control Component Assembly	N/A

It was decided to provide proportional thermal control to maintain the LNA at $37 \pm 2^{\circ}C$. The controller operates directly from the regulated 28 volt spacecraft bus and is independent of the SASS operating mode, including the "off" condition. The thermal design is such that the $37 \pm 2^{\circ}C$ can be maintained for any baseplate temperature in the range of 0° to $+35^{\circ}C$, the temperature range over which the Scatterometer must operate in specification. Below $0^{\circ}C$, the controller will maintain a nominal 35° ΔT above the baseplate temperature. Above $+35^{\circ}C$, the controller will be essentially turned off and the ΔT will be approximately 2.8° above the baseplate temperature.

3.1.3 HIGH VOLTAGE POWER SUPPLY

There were three circuit design changes in the HVPS during the course of the program. The circuit changes were associated with the following problems:

Minor Looping
Inrush current at HVPS ENABLE Command
Inrush current at Mode 1 to 9 Command

3.1.3.1 Minor Looping

Minor looping is a phenomenon associated with asymmetrical operation on the transformer B-H curve. This phenomenon caused failures in the boost transistor through an apparent susceptibility to transients.

Previous circuit modifications to eliminate minor-looping problems were primarily aimed at reducing the effect to within tolerable levels. These modifications worked reasonably well for most conditions, but did not eliminate the problem. Transients can cause the boost to minor loop severely, even to the point of destruction. To offset this, a new circuit was developed to sense minor-looping, generate an "error" signal that feeds back into the control loop to automatically eliminate the problem. It is an internal control loop with enough gain to nearly eliminate minor looping, but which does not affect normal operation in any way.

3.1.3.2 Inrush Current at HVPS ENABLE Command

During system level tests, a problem appeared which caused the crowbar protection circuit in the unregulated bus voltage line in the STC/RSS to actuate when a "HVPS ENABLE" command was issued. This problem was intermittent, but appeared to be temperature sensitive since the problem occurred more often at the cold temperature. Troubleshooting isolated the problem to a marginal control condition during the turn-on transient. Occasionally, both boost transistors would turn-on simultaneously thus effectively applying a short circuit on the unregulated bus. A slight circuit modification was incorporated into the HVPS design to insure that the boost transistors are held off during the turn-on transient.

3.1.3.3 Inrush Current at Mode 1 to 9 Command

Inrush current measurements were made when a mode command was given after the three minute time out. When it was observed that the inrush current exceeded the specification, the input current trip circuit was modified to act as a current limiter during "turn-on". At the SASS instrument level, two conditions must be discussed. The first condition is when a mode 1 to 9 command is given after "HVPS ENABLE" command but before the three minute time out while the second condition is when a mode 1 to 9 command is given after the "HVPS ENABLE" command and after the three minute time out.

Condition 1: When the mode 1 to 9 command is given between the "HVPS ENABLE" command and the three minute time out, the HVPS tries to bring the TWT cathode voltage to -8 KV at the end of the time out. This causes the input current to exceed the threshold level and the trip actuates. Since the mode 1 to 9 command is no longer present, the current simply decays to its previous value. The TWT cathode voltage and collector voltages are turned off and the TWT returns to a Standby condition.

Condition 2: When the mode 1 to 9 command is given after the "HVPS ENABLE" command and after the three minute time out, the HVPS tries to bring the TWT cathode voltage to -8 KV. This causes the input current to exceed the threshold level and the trip circuit again actuates. However, once the current decays below a certain threshold level, the mode 1 to 9 command is still present and resets the trip circuit. Once again, the HVPS tries to bring the TWT cathode from its present level to -8 KV and again the trip circuit actuates. This trip circuit actuation occurs typically five times during the first three milliseconds after the mode 1 to 9 command. By this time the HV capacitors in the HVPS are sufficiently charged and the input current settles down to its normal operation. The digital controller pulse, associated with a mode 1 to 9 command, was stretched out to 8.3 milliseconds to assure that the internally generated mode command pulse was still there after the last trip circuit excursion.

3.2 DESIGN DEVELOPMENT (MECHANICAL)

In the proposal concept the SASS was envisioned as a collection of approximately 20 electronic and microwave components to be integrated at the spacecraft level with GFE antennas and TWT. See Figure 3.2-1.

At the beginning of detailed hardware design, it became apparent that this would have been a difficult and expensive interface, and it was decided to integrate the experiment as a component on its own baseplate, which would then be mounted to the spacecraft structure.

A combination dust cover and EMI shield was added later. See Figure 2.2.1-1.

The major problems to be overcome in the mechanical design were: 1) developing a layout of components having logical signal flow, within the confines of the 1.0 X 0.41 X 0.35 M, since most components were interconnected by rigid waveguide; 2) designing waveguide supports with sufficient adjustment to provide for assembly tolerances and capable of meeting vibration and shock requirements; 3) weight optimization of the structure design at a late stage in the instrument development, and 4) adapting existing high voltage packaging techniques to meet new, more complex module designs.

Other challenges met in the mechanical development were the thermal control of the LNA, negotiation and maintenance of mechanical interfaces with numerous sub- and co-contractors, and electronic packaging designs for high and low voltage power supplies, digital controller and scatterometer processor.

The mechanical and packaging designs were proven by environmental test. Vibration and shock to qual levels produced only two failures (see page 68, SAS 06, 07) neither of which was design related. Thermal-vacuum testing verified the thermal analysis and high voltage design implementation.

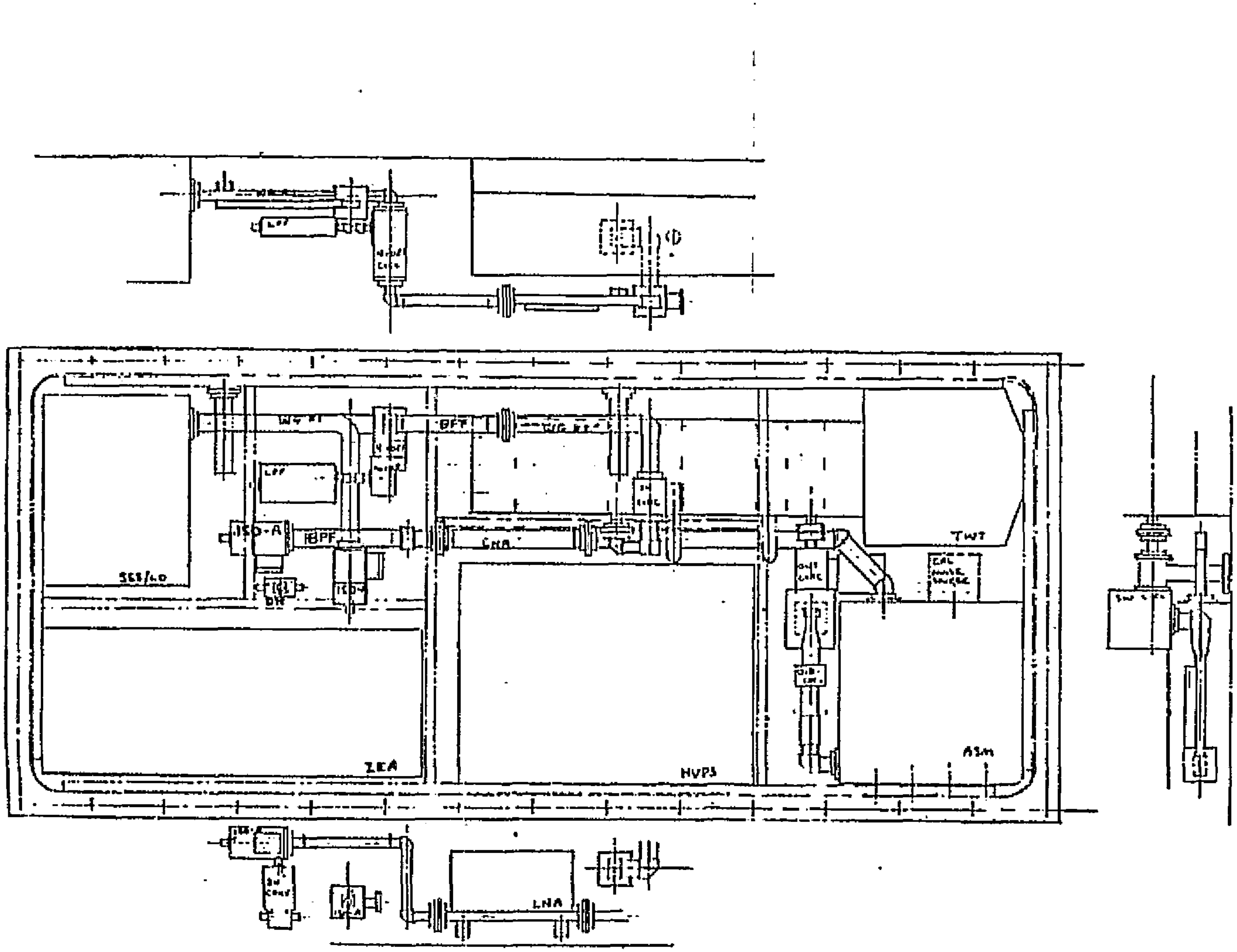


Figure 3.2-1. SASS General Arrangement

SECTION 4

TEST PROGRAM

SECTION 4

TEST PROGRAM

4.1 TESTS PERFORMED AT GE

The SASS instrument test program is outlined in the following tables:

- Table 4.1-1, Subsystem Qual Tests
- Table 4.1-2, Initial Functional and Baseline Tests
- Table 4.1-3, SASS System Level Test Flow
- Table 4.1-4, SASS Instrument Operating Times
- Figure 4.1-1, Thermal Vacuum Profile
- Figure 4.1-2, SASS Shock Spectra
- Figure 4.1-3, Random Vibration Levels

Table 4.1-1. Subsystem Hardware Matrix – Qualification Tests

	Shock	Random Vib. 3 Axis	Sine Reson. Search	Acoustic Noise	EMI	Thermal Vacuum	High/Low Temp. (Amb Pres)	Electrical		Magnetic Moment
								Func.	Perform.	
SSS/LO (SVS 8890)	–	X	X	–	X	–	X	X	X	–
W/G Component #1	–	–	–	–	–	–	–	X	X	–
Upconverter (Inc. BPF)	–	–	–	–	–	–	X	X	X	X
W/G Component #2	–	–	–	–	–	–	–	X	X	–
Input/Ouput Isolators and ISO Adapters	X	X		–	–	–	X	X	X	X
100 Watt TWT	←					GFP				→
Directional Detector	–	–	–	–	–	–	X	X	X	–
High Voltage Power Supply	–	–	–	–	–	X	X	X	X	–
Antenna Switching Matrix (SVS 8891)	X	X	–	–	–	–	X	X	X	X
Noise Source	X	X	–	–	–	–	X	X	X	–
TDA	X	X	–	–	–	–	X	X	X	X
Downconverter	X	X	–	–	–	–	X	X	X	–
Integrated Elect. Assy. (DC/DC, Dig. Cont., SCAT Processor)	–	–	–	–	–	–	X	X	X	–

Legend: X = Test was Conducted
– = No Test Conducted

Table 4.1-2. Initial Functional and Baseline Tests

- Pre-Power Configuration
  - Ground Isolation
  - Continuity and Impedance Checks
  - GSE Checkout
- Initial Power On
  - Interface Signal Verification
- Operational Checks
  - Command Checks
  - Signal and Test Point Evaluation
  - Telemetry Signals
  - Blanking Signals
  - SSS/LO Checks
  - ASM Phasing Checks
  - Calibration Cycle Verification
  - R. F. Levels
  - HVPS Checks
  - Telemetry Data Verification
  - LNA Heater Test
- Performance Baseline Test (Nominal, High, and Low Input Voltage)
  - Power Subsystem
  - Transmitter Performance
  - Receiver Performance
  - Data System Performance

Table 4.1-3. SASS System Level Test Flow

- Operational Checks
- Functional Tests
- Performance Baseline

Vibration/Shock

- Sine Resonant Search
- Random Vibration
- Synthesized Shock
- Between Axis Confidence Tests

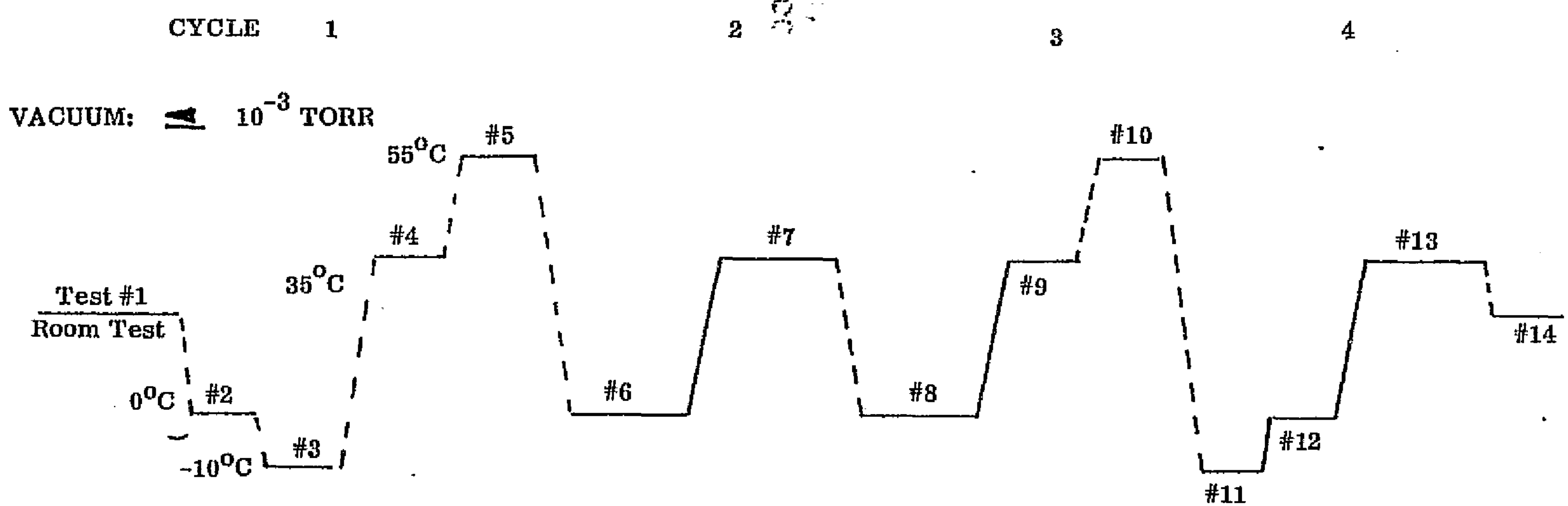
Thermal Vacuum

- Hot/Cold Starts
- Performance Tests
- Confidence Tests
- EMI (Conducted Emission of Transients)
- Final Calibration (25°C)

- HVPS Retrofit
- Final Confidence (0° and 25°C)

Table 4.1-4. SASS Instrument - Operating Times

Item No.	Drawing No.	Description	Serial No.	Completed Oper. Time	System Time	Total
-	47E235000G1	SASS Instrument	JJ732	-	325 Hrs 18 Min	325 Hrs 18 Min
A1	47D235460P1	SSS/LO	001	162 Hrs 0 Min	325 Hrs 18 Min	487 Hrs 18 Min
A2	47E235250G1	IEA Assembly	001/JH802	≈ 84.1 Hrs	325 Hrs 18 Min	409 Hrs 24 Min
A3	47E235100G1	HVPS	001/JJ090	≈ 101 Hrs	125 Hrs 36 Min	226 Hrs 36 Min
A4	47D235458P1	100 Watt TWT	EM-1	778 Hrs 24 Min	113 Hrs 30 Min	891 Hrs 54 Min
A6	47C235451P1	TWT Input ISOL	4	12 Hrs 0 Min	325 Hrs 18 Min	337 Hrs 18 Min
A7	47C235452P1	TWT Output ISOL	5	12 Hrs 0 Min	325 Hrs 18 Min	337 Hrs 18 Min
A9	47E23545P1	Ant. Sw. Matrix	2	80 Hrs 0 Min	325 Hrs 18 Min	337 Hrs 18 Min
A10 Item 4	47D235456P1	Tunnel Diode Amp	6812	129 Hrs 12 Min	325 Hrs 18 Min	454 Hrs 30 Min
A11	47C235453P1	ISO Adapter	5	12 Hrs 0 Min	325 Hrs 18 Min	337 Hrs 18 Min
A12	47C235455P1	Down Converter	3	51 Hrs 7 Min	325 Hrs 18 Min	376 Hrs 25 Min
A13	47C235453P1	ISO Adapter	6	12 Hrs 0 Min	325 Hrs 18 Min	337 Hrs 18 Min



Test No.	Test	V_{IN}
Test #1	Conf. and Perf.	Nominal
Test #2	*Conf. and Perf.	Hi, Low and Nom.
Test #3	Confidence	Nominal
Test #4	*Conf. and Perf.	Hi and Low
Test #5–#13	Confidence	Nominal
Test #14	*Conf. and Inst. Cal.	Nominal

CODE:

- - - - - - INSTR. OFF

———— INSTR. ON

* Performance test at nominal input voltage only.

Figure 4.1-1. Thermal Vacuum Profile

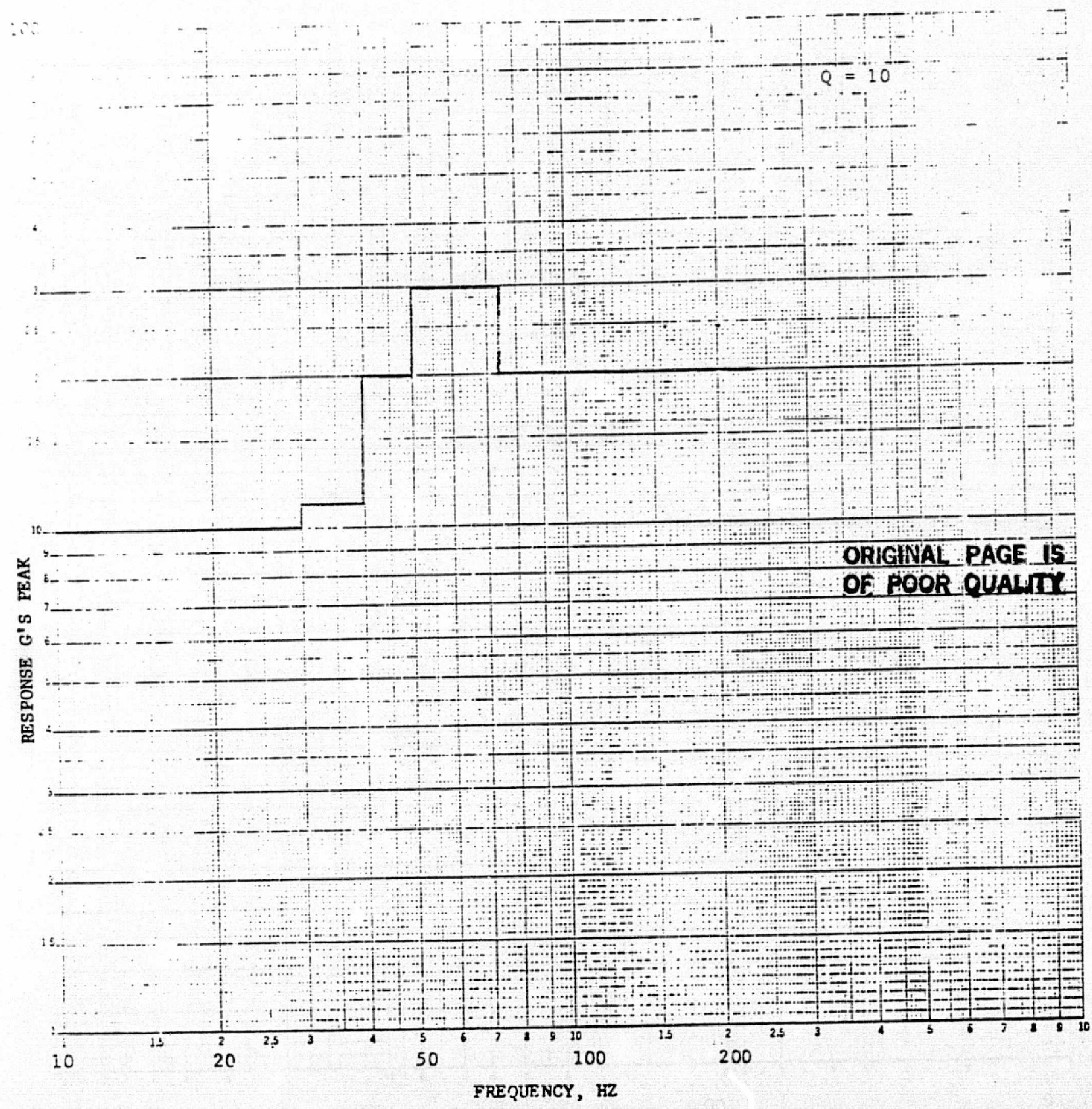


Figure 4.1-2. SASS Shock Spectra Envelope of Flight Transients (Z Axis)

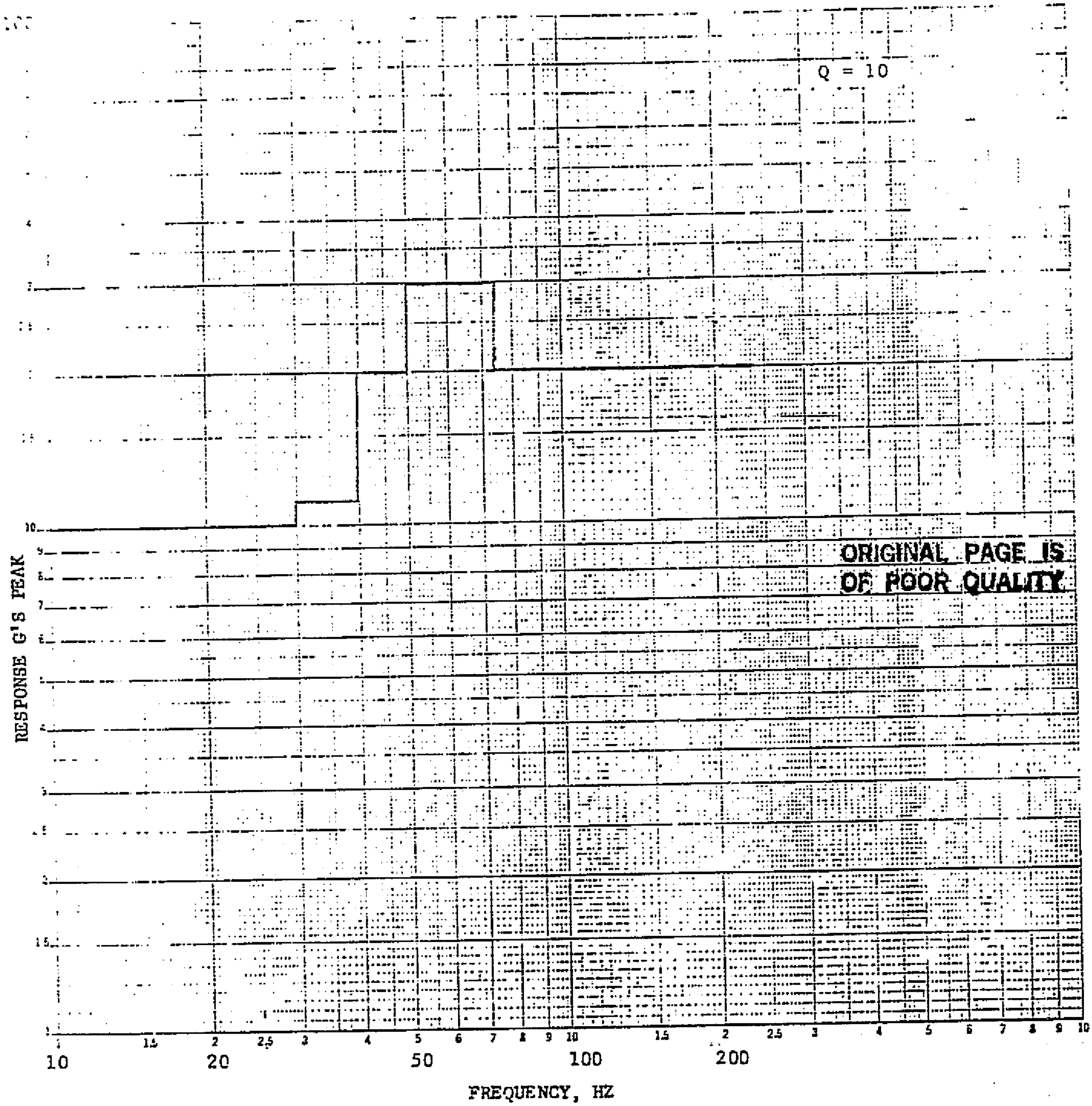


Figure 4.1-2. SASS Shock Spectra Envelope of Flight Transients (Z Axis)

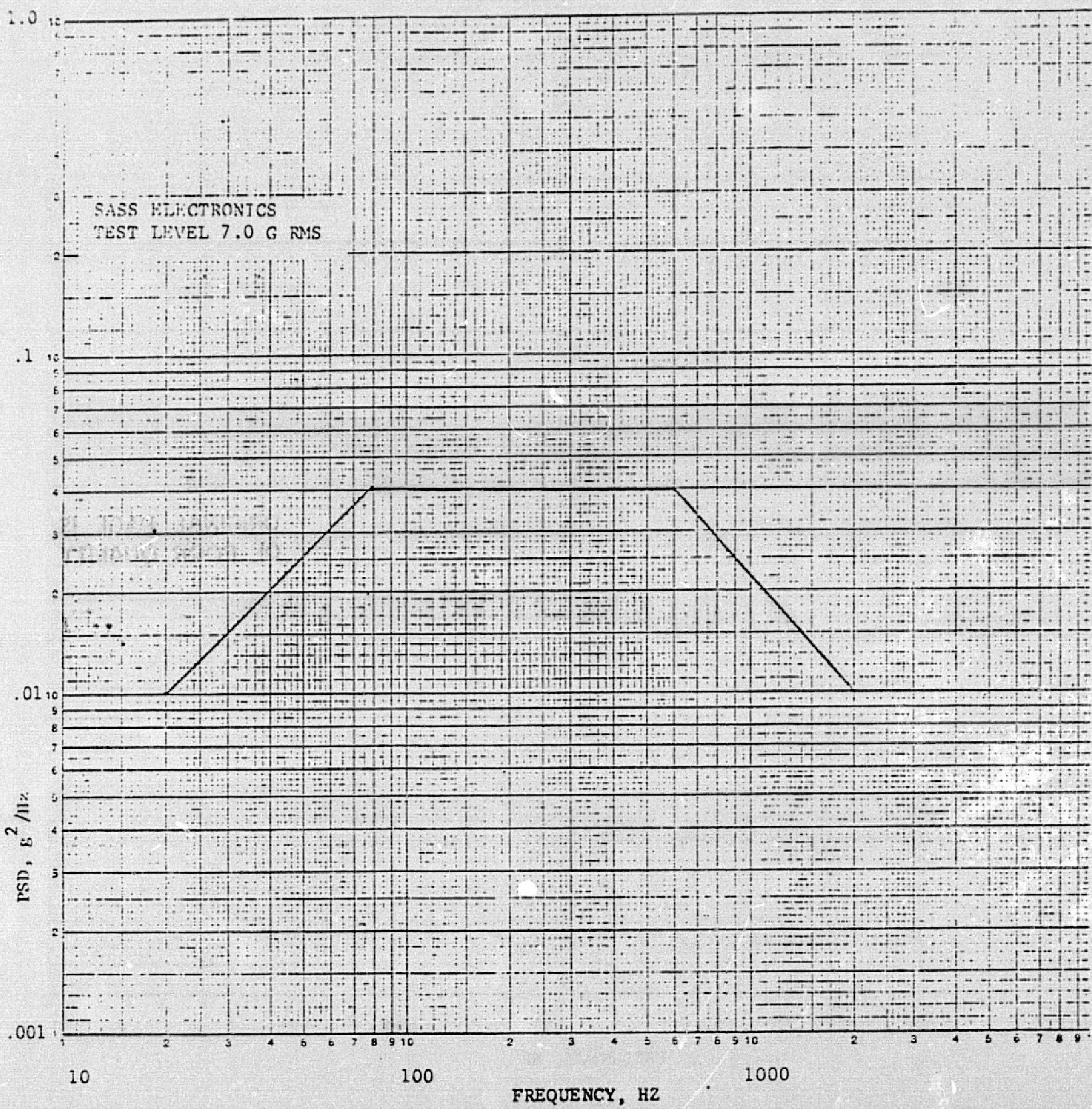


Figure 4.1-3. Random Vibration Levels

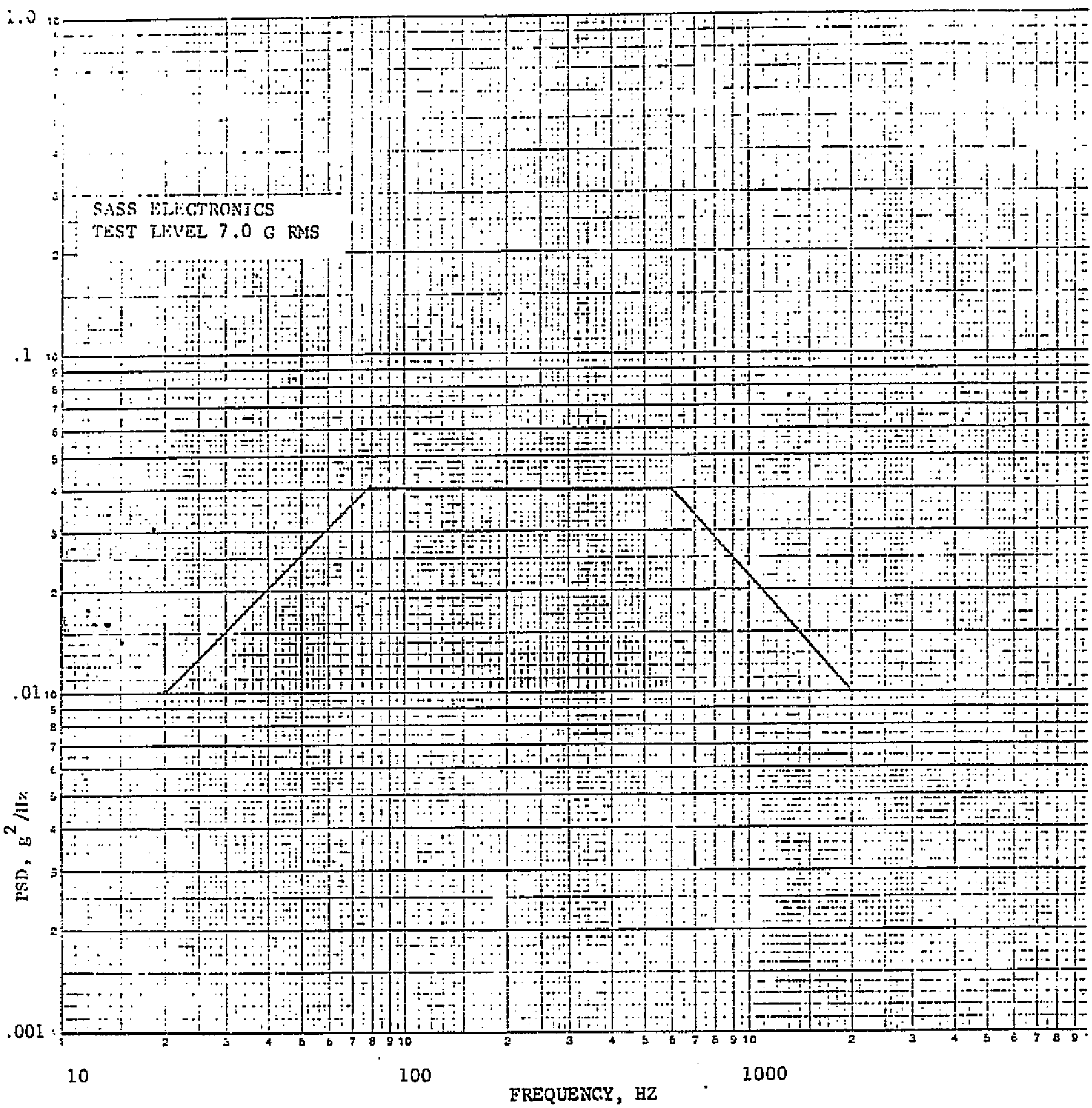


Figure 4.1-3. Random Vibration Levels

4.2 TESTS PERFORMED AT LMSC

4.2.1 SASS TESTS (INSTRUMENT LEVEL)

Bench Acceptance Test - A confidence test (part of SI 250046) was performed at LMSC after the Scatterometer had been uncrated, mounted on the handling dolly and connected to the STC/RSS (System Test Console/Return Signal Simulator). The successful completion of this test clearly indicated that no damage to the SASS instrument had occurred during shipment.

Transmitter Tests - A field retrofit, with QM-1 TWT and HVPS #2 replacing EM-1 TWT and HVPS #1 respectively, was made.

Following the retrofit, a bonding check was made on the EMI shield and connectors as well as on any components that had been disconnected during the retrofit.

The SASS instrument was then connected to the STC/RSS and a confidence test performed to verify functional performance. The transmitter calibration portions of SI 250046 were also performed to provide a final set of data for the P_T algorithm.

The last test performed at the SASS instrument level was thermal vacuum.

4.2.2 SASS TESTS (AS PART OF SENSOR MODULE)

The SASS tests performed as part of the Sensor Module included a review of the Test Procedure, support at the test facility and a post test data review, all performed by SASS sensor personnel. Table 4.2-1 shows the test sequence at the Sensor Module and higher levels of assembly.

Table 4.2-1. Test Sequence (Sensor Module and Higher Levels of Assembly)

• Mechanical Fit Check	• RFI Test
• Sensor Integration Test	• Acoustic Test
• Baseline Systems Test	• Thermal Vacuum Test
• EMI Test	• Baseline System Test (Pre-Ship)
• POCC Compatibility Test	• Launch Site Tests

SECTION 5

GROUND SUPPORT EQUIPMENT

SECTION 5

GROUND SUPPORT EQUIPMENT

Figure 5-1 summarizes the Electrical and Mechanical equipment associated with the SASS development. Figure 5-2 indicates the command and data portions of the STC/RSS while Figure 5-3 is a functional block diagram of the return signal simulator and transmit power monitor. Also shown in Figure 5-2 is the JPL Blue Box. This box stripped the SASS and other sensors data from the spacecraft data stream and fed it to the respective GSE's. When the "Blue" box was connected, it performed a monitor function only and no control of the SASS instrument could be exercised by the STC/RSS. With the "Blue" box in line, the Data Handling Unit and Buffer Memory portions of the STC/RSS provided a real time display and a magnetic tape recording of the SASS data stream.

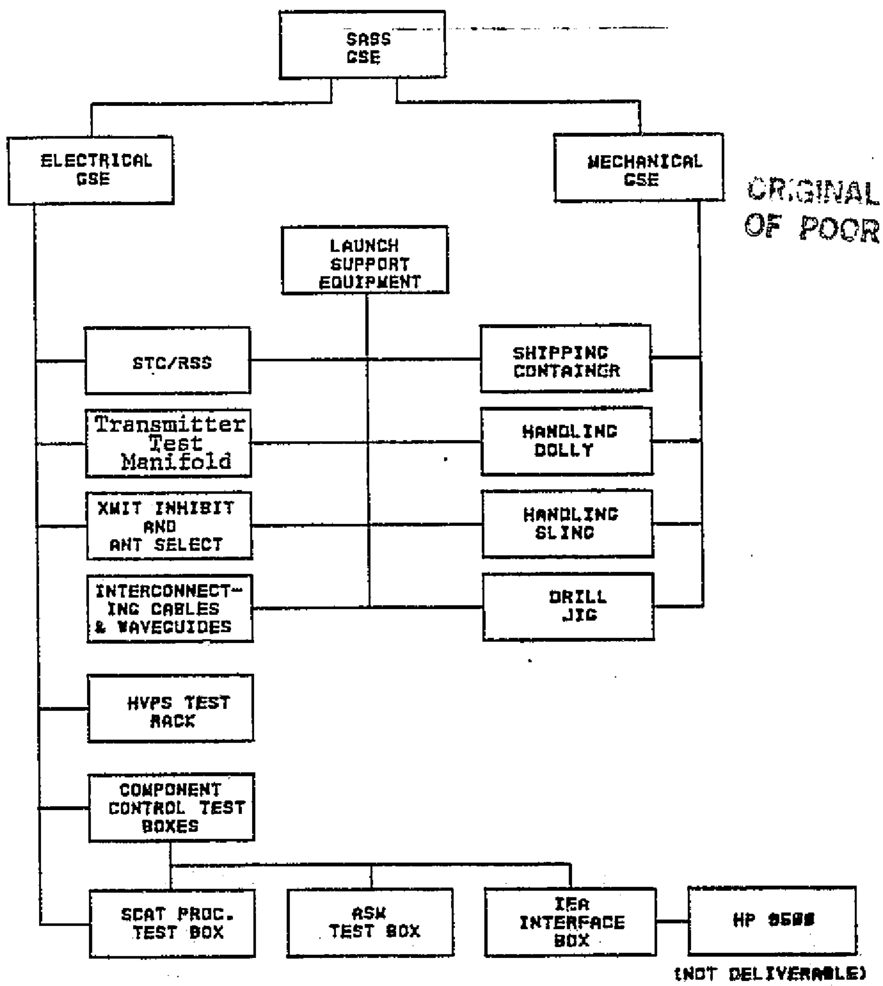


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Figure 5-1. SASS GSE

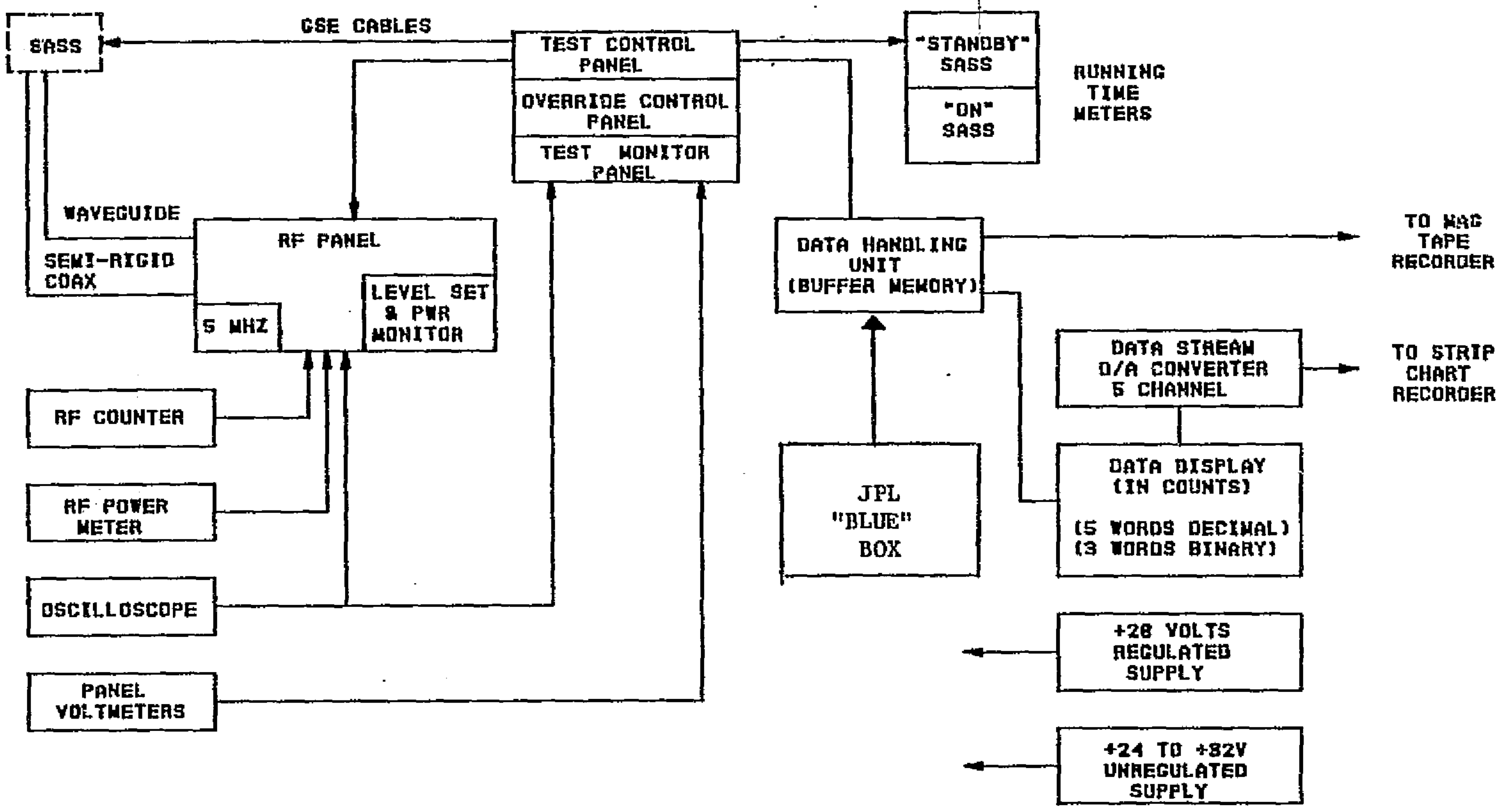

Figure 5-2. SASS STC/RSS

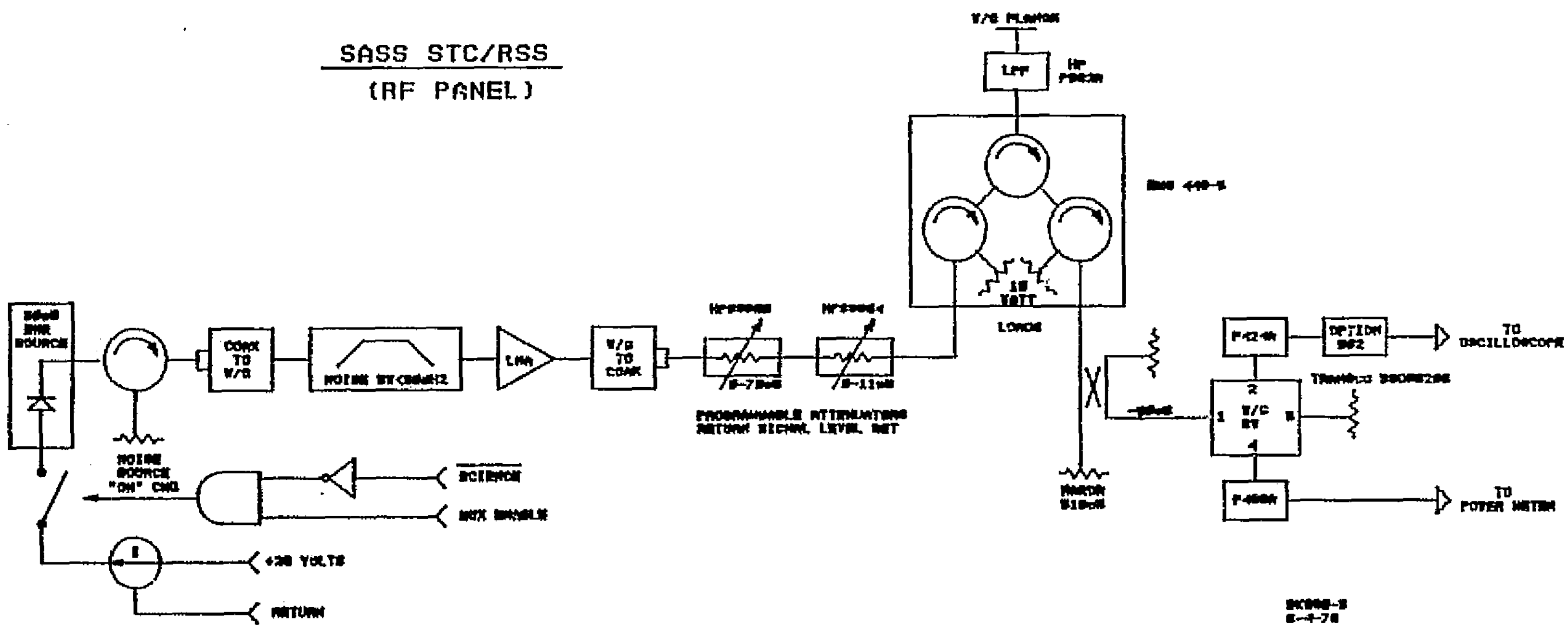

Figure 5-3. SASS STC/RSS (RF Panel)

SECTION 6

SOFTWARE DEVELOPMENT

SECTION 6

SOFTWARE DEVELOPMENT

The software for the SASS instrument can be separated into five categories. They are:

- SASS Corrected Data (Engineering Units)
- P_R and P_T Algorithm (With Statistics)
- Field Test (Data Compression)
- Operational TLM (Health of SASS Instrument)
- Operational (Science Data)

SASS Corrected Data (Engineering Units) - The software associated with the SASS Corrected Data is described in PIR 1JL6-JH-452. Figure 6-1 flow charts this data from the raw data stream through to the formatted output of corrected data in engineering units.

Figure 6-2 shows one data frame from the SASS Instrument. The data is grouped functionally to include Status, Science Data, Analog Housekeeping Data, Instrument Internal Temperature Data and Antenna Temperature Data.

P_R and P_T Algorithm (With Statistics) - The Algorithm for P_R and P_T, Power received and Power transmitted respectively, was jointly developed by GE and LARC. The majority of the test data reduction, including statistics to evaluate sensor performance, has been done at LARC. PIR 1JL6-JH-429 describes the algorithm and identifies the terms and is included as Appendix 1.

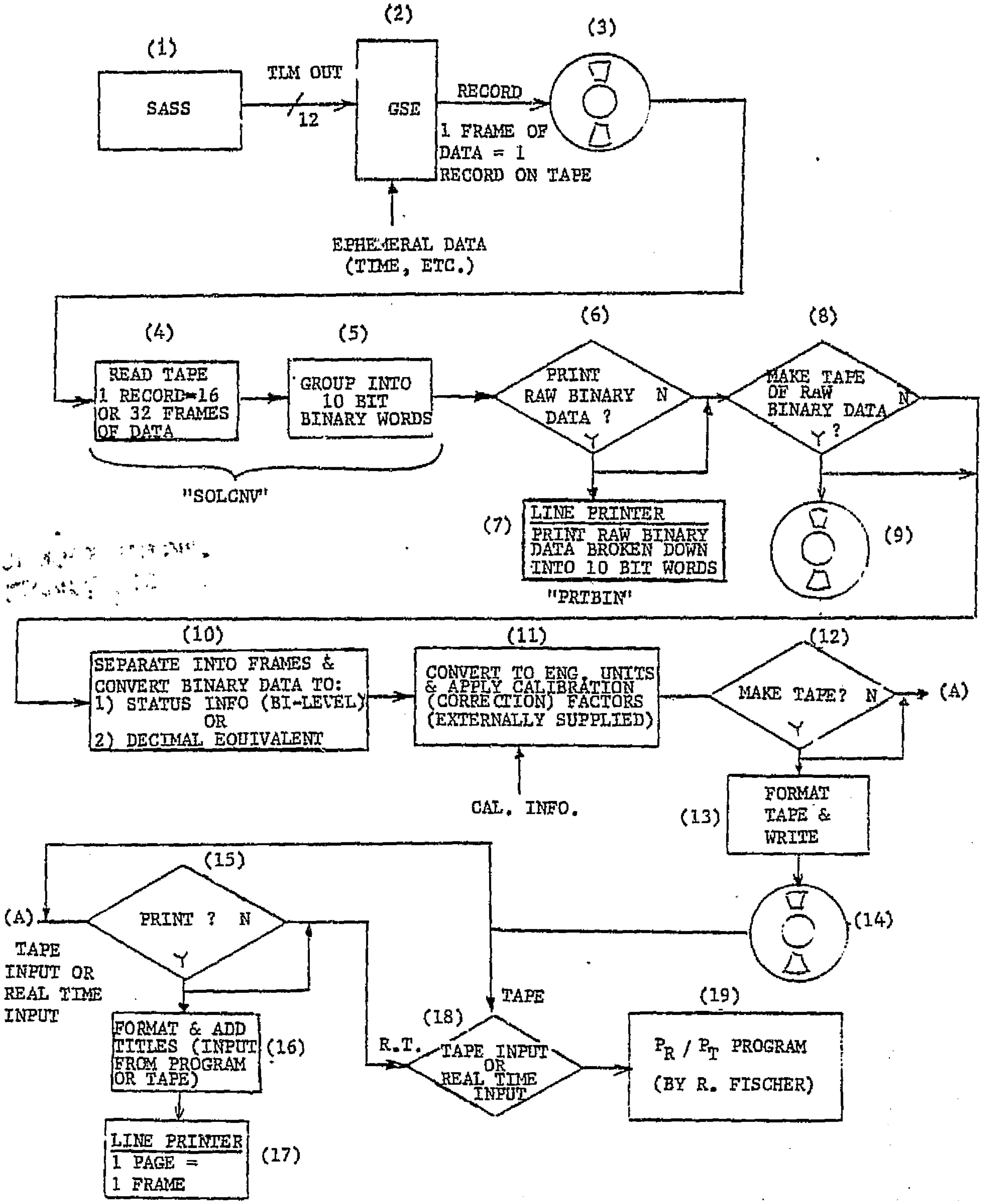

Figure 6-1. Outline of Data Flow and Data Processing Requirements

RECORD NUMBER 1214

STATUS:

MODE	DATA	CAL	ANT PORT	PROT	FREQ	SLO LOOP	XMIT LOOP	TRIPS
0	SCIENCE	--	V L A	P	HIGH	LOCK	LOCK	IN UV IW

SCIENCE DATA: H.K. DATA:

CHAN	GAIN	S+SN	SN				
1	2	0.606 V	0.762 V	GRND.(WD#65)	0. V	ION PUMP CUR	0. UA
2	2	0.508 V	0.645 V	GRND.(WD#79)	0.029 V	INPUT CURRENT	0. A
3	1	4.272 V	5.132 V	TH REF V #1	5.103 V	XMT PWR (SSSLO)	17.400 DBM
4	1	4.037 V	4.643 V	TH REF V #2	5.103 V	UNCONV BIAS	0.102 V
5	1	3.529 V	3.734 V	CATH VOLTAGE	-7833.000 V	TDA #1	0.137 V
6	1	3.069 V	3.148 V	CATH CURRENT	0. MA	TDA #2	0.160 V
7	1	2.600 V	2.473 V	SLO PWR	11.870 DBM	TDA #3	0.170 V
8	1	2.414 V	2.072 V	XMIT PWR	0.020 WATTS	SPARE (WORD 62)	0. V
9	1	2.180 V	1.691 V	MOD PWR MON	21.276 DBM	SPARE (WORD 63)	0. V
10	1	1.926 V	1.329 V	+5 VOLTS	5.142 V	SPARE (WORD 66)	0. V
11	1	1.740 V	1.212 V	+15 VOLTS	15.019 V	SPARE (WORD 71)	0. V
12	1	1.427 V	1.017 V	-15 VOLTS	-15.064 V	SPARE (WORD 72)	0.020 V
13	2	0.557 V	0.792 V	-6 VOLTS	-6.047 V	SPARE (WORD 73)	0.010
14	2	0.528 V	0.762 V	+6 VOLTS	5.994 V	SPARE (WORD 74)	0.010 V
15	2	0.528 V	0.753 V	BODY CURRENT	0. MA	SPARE (WORD 80)	0. V
						SPARE (WORD 81)	0.010 V
						SPARE (WORD 82)	0.020 V

TEMPERATURE DATA: SUBCOM I.D. CURRENTLY UPDATING: 8

SSS/LO	5.9	B.P. #1	1.8	UPCONV	1.1	ANT 1-1	15.1	ANT 1-2	15.1	ANT 1-3	15.2	ANT 1-4	15.1	ANT 1-5	15.2
TWT #1	2.9	TWT #2	0.5	TWT #3	1.6	ANT 1-6	15.1	ANT 1-7	15.1	ANT 1-8	15.1	ANT 1-9	15.1	ANT 1-10	15.1
B.P. #2	2.6	B.P. #3	-0.0	OUT ISO	1.3	ANT 3-1	14.9	ANT 3-2	15.0	ANT 3-3	14.9	ANT 3-4	15.1	ANT 3-5	15.1
ASM	3.0	TDA	32.7	B.P. #4	1.3	ANT 3-6	15.0	ANT 3-7	15.1	ANT 3-8	15.1	ANT 3-9	15.1	ANT 3-10	15.1
B.P. #5	2.3	HVPS CH	0.5	FILT P6	17.3	ANT 2-1	14.9	ANT 2-2	14.7	ANT 2-3	14.8	ANT 2-4	14.8	ANT 2-5	14.7
FILT P1	22.5	FILT P10	22.3	FIL P12	20.8	ANT 2-6	14.9	ANT 2-7	14.8	ANT 2-8	14.9	ANT 2-9	14.9	ANT 2-10	15.0
A/D CNV	20.4	B.P. #6	2.7	NOISE S	1.1	ANT 4-1	15.0	ANT 4-2	15.1	ANT 4-3	15.3	ANT 4-4	15.1	ANT 4-5	15.1
DIRDET	3.8	DNCONV	2.8	2ND MIX	13.3	ANT 4-6	15.1	ANT 4-7	15.2	ANT 4-8	15.3	ANT 4-9	15.1	ANT 4-10	15.1

EPHEMERIS DATA: TIME: 273: 1:26:31

1111 1111 1111 1111 1111 1111 1111

Figure 6-2. Data Frame from the SASS Instrument

Field Test Data (Data Compression) - SASS Field Test Data was reduced using data compression techniques which included apertures and limits so that a printout was obtained only when a parameter changed by an amount greater than the aperture. The parameters associated with each SASS sub-deck is listed below:

SASS Sub-Deck 1-1	
SS700	Mode 1
SS701	Mode 2
SS702	Mode 3
SS703	Mode 4
SS704	Mode 5
SS705	Mode 6
SS706	Mode 7
SS707	Mode 8
SS708	Mode 9
SS709	Mode 10

SASS Sub-Deck 1-2	
SS711	Polarization
SS712	Left/Right
SS713	FWD/AFT
SS714	LO Freq. Sel.
SS715	HI Freq. Sel.
SS772	LO PWR
SS773	MOD PWR
SS774	XMIT Channel PWR
SS770	LO Loop Lock Status
SS771	XMIT Loop Lock Status
SS779	Rec. Protect
SS854	Sub. Com. Count

SASS Sub-Deck 1-3	
SS761	XMIT PWR
SS762	Input Current Trip
SS763	Undervoltage Trip
SS764	Body Current Trip
SS765	E_F
SS766	I_K
SS767	I_W
SS768	I_{IP}
SS769	HVPS Input Current
SS862	I_F

SASS Sub-Deck 1-4	
SS775	Upconverter Bias
SS776	TDA 1 Bias
SS777	TDA 2 Bias
SS778	TDA 3 Bias
SS781	DC/DC Conv. + 5 V
SS782	DC/DC Conv. +15 V
SS783	DC/DC Conv. -15 V
SS785	DC/DC Conv. - 6 V
SS786	DC/DC Conv. + 6 V
SS787	TH. Ref. #1
SS788	TH. Ref. #2

SASS Sub-Deck 1-5		
SS716	CH1	Gain
SS717	CH2	Gain
SS718	CH3	Gain
SS719	CH4	Gain
SS731	CH1	Signal + Noise
SS732	CH2	Signal + Noise
SS733	CH3	Signal + Noise
SS734	CH4	Signal + Noise
SS746	CH1	Noise Only
SS747	CH2	Noise Only
SS748	CH3	Noise Only
SS749	CH4	Noise Only

SASS Sub-Deck 1-6		
SS720	CH5	Gain
SS721	CH6	Gain
SS722	CH7	Gain
SS723	CH8	Gain
SS735	CH5	Signal + Noise
SS736	CH6	Signal + Noise
SS737	CH7	Signal + Noise
SS738	CH8	Signal + Noise
SS750	CH5	Noise Only
SS751	CH6	Noise Only
SS752	CH7	Noise Only
SS753	CH8	Noise Only

SASS Sub-Deck 1-7		
SS724	CH9	Gain
SS725	CH10	Gain
SS726	CH11	Gain
SS727	CH12	Gain
SS739	CH9	Signal + Noise
SS740	CH10	Signal + Noise
SS741	CH11	Signal + Noise
SS742	CH12	Signal + Noise
SS754	CH9	Noise Only
SS755	CH10	Noise Only
SS756	CH11	Noise Only
SS757	CH12	Noise Only

SASS Sub-Deck 1-8		
SS728	CH13	Gain
SS729	CH14	Gain
SS730	CH15	Gain
SS743	CH13	Signal + Noise
SS744	CH14	Signal + Noise
SS745	CH15	Signal + Noise
SS758	CH13	Noise Only
SS759	CH14	Noise Only
SS760	CH15	Noise Only

SASS Sub-Deck 2-1	
SS789	Baseplate RT 3, SSS/LO
SS790	Baseplate RT 5, TWT Gun
SS791	Baseplate RT 14, TWT Coll.
SS792	Baseplate RT 7, HVPS, LNA
SS793	Baseplate RT 17, HVPS TWT Coll.
SS794	Baseplate RT 18, SSS/LO Dig. Cont.
SS795	Baseplate RT 6, Gun
SS796	Baseplate RT 10, Output Port
SS797	Baseplate RT 16, Coll. Plate
SS798	Baseplate RT 13, Output ISO
SS799	Baseplate RT 9, HVPS
SS800	Baseplate RT 12, ASM

SASS Sub-Deck 2-2	
SS801	Baseplate RT 1, SSS/LO
SS803	Baseplate RT 2, Upconverter
SS804	A/D Converter
SS805	Baseplate RT 15, Noise Source
SS806	Baseplate RT 11, Directional Detector
SS807	Baseplate RT 4, 1st. Mixer
SS808	2nd. Mixer
SS809	Baseplate RT 8, TDA
SS810	Crystal Filter P6
SS811	Crystal Filter P1
SS812	Crystal Filter P10
SS813	Crystal Filter P12

SASS Sub-Deck 2-3		
SS814	Ant. #1	Temp. #1
SS815	Ant. #1	Temp. #2
SS816	Ant. #1	Temp. #3
SS817	Ant. #1	Temp. #4
SS818	Ant. #1	Temp. #5
SS819	Ant. #1	Temp. #6
SS820	Ant. #1	Temp. #7
SS821	Ant. #1	Temp. #8
SS822	Ant. #1	Temp. #9
SS823	Ant. #1	Temp. #10
SS824	Ant. #2	Temp. #1
SS825	Ant. #2	Temp. #2

SASS Sub-Deck 2-4		
SS826	Ant. #2	Temp. #3
SS827	Ant. #2	Temp. #4
SS828	Ant. #2	Temp. #5
SS829	Ant. #2	Temp. #6
SS830	Ant. #2	Temp. #7
SS831	Ant. #2	Temp. #8
SS832	Ant. #2	Temp. #9
SS833	Ant. #2	Temp. #10
SS934	Ant. #3	Temp. #1
SS835	Ant. #3	Temp. #2
SS836	Ant. #3	Temp. #3
SS837	Ant. #3	Temp. #4

SASS Sub-Deck 2-5		
SS838	Ant. #3	Temp. #5
SS839	Ant. #3	Temp. #6
SS840	Ant. #3	Temp. #7
SS841	Ant. #3	Temp. #8
SS842	Ant. #3	Temp. #9
SS843	Ant. #3	Temp. #10
SS844	Ant. #4	Temp. #1
SS845	Ant. #4	Temp. #2
SS846	Ant. #4	Temp. #3
SS847	Ant. #4	Temp. #4
SS848	Ant. #4	Temp. #5
SS849	Ant. #4	Temp. #6

SASS Sub-Deck 2-6		
SS850	Ant. #4	Temp. #7
SS851	Ant. #4	Temp. #8
SS852	Ant. #4	Temp. #9
SS853	Ant. #4	Temp. #10
SS855	Spare (0)	
SS856	Spare (0)	
SS857	Spare (1)	15 Cnts.
SS858	Spare (1)	15 Cnts.
SS859	Spare (0)	
SS860	Spare (0)	
SS861	Spare (1)	255 Cnts.
SS863	LO Gain GND RED.	

SASS Sub-Deck 2-7	
SS864	LO Gain GND RED.
SS865	XMIT PWR RED.
SS866	XMIT PWR RED.
SS867	XMIT PWR RED.
SS868	XMIT PWR RED.
SS869	HI Gain GND
SS870	HI Gain GND RED.
SS871	HI Gain GND RED.
SS872	HI Gain GND RED.
SS784	LO Gain GND

SASS Sub-Deck 2-8	
LA121	Baseplate Temp. #1
LA122	Baseplate Temp. #2
LC101	Unregulated +28
LC117	SASS +28 Regulated
LC135	SASS Current
SS873	Sync 346
SS874	Sync 602
SS875	Sync 427

SASS Sub-Deck 3	
LC135	SASS Total Current
LC135	Maximum
LC135	Minimum
LC135	Mean
LC135	Standard Deviation

Operational TLM (Health of Instrument) - The software for the Operational TLM, Health of Instrument is being done at the POCC (Project Operations Control Center) at GSFC. The SASS associated software includes the following data:

- TLM Page - Sensor ON/OFF Status
- Quicklook, Page 1 - TWT Parameters
- Quicklook, Page 2 - Scatterometer Systems Status
- SASS, Page 1 - Status Data
- SASS, Page 2 - Analog Engineering Data
- SASS, Page 3 - Internal Temperatures
- SASS, Page 4 - Science Data
- SASS, Page 5 - Alarm Parameters
- Scatterometer System All Data Snapshot

A snapshot of each of these pages is included for information purposes.

SENSOR ON/OFF STATUS

```
ORB:00000   SYS: C07   PTCH:-.95300   SUN:NO            CMD ACC:178   GMT-122:17:47:48
PRI: PB     QUAL:GOOD  ROLL:.605278   BUS VLT:27.50     CMD EXC:152   SCT-001:02:05:10
SRCE:TAPE              YAW:  N.A.     PTE:N.A. N.A.     MEM:ENABLE    FRAME LOCK:00956
******************************  T L M   P A G E  ******************************
 BLOCK TYPE - STATUS      BLKS RCVD    TIME LAST BLK      BLKS MISSED   SUBCOM CNTR
        LRS - ON           00035       001:02:05:10:808     00001           05
        ALT - ON           09358       001:02:05:10:815     00000           01
       SASS - ON           00071       001:02:05:09:632     00000           07
       SMMR - ON           00086       001:02:05:09:721     00000           02
        SAR - ON           00048       001:02:05:09:707     00000           07
       VIRR - ON           00143       001:02:05:09:931     00000           **
        ASC - ON           00000       001:00:00:00:000     00000           **
        ADJ - ON           00000       001:00:00:00:000     00000           **
        ORB - ON           00078       001:02:05:10:288     00000           **
       DUMP - ON           00131       001:02:05:10:972     00000           **

 POLY - ON
 TLMEVENT - OFF
 CALPASS - OFF
```

QUICKLOOK PAGE 1

```
ORB:00000   SYS: C07    PTCH:-.94400   SUN:NO          CMD ACC:170   GMT-122:17:48:13
PRI: PB     QUAL:GOOD   ROLL:.775997   BUS VLT:27.50   CMD EXC:152   SCT-001:02:05:11
SRCE:TAPE               YAW:  N.A.     PTE:N.A. N.A.   MEM:ENABLE    FRAME LOCK:00992
PAGE 14       QUICKLOOK PAGE 1  ALT,SASS,SMMR,VIRR, AND SAR QUICKLOOK
```

ALT				SASS			
ATU MODE	TRK1		00259	TWT CATHODE VOLT	-0.023	KV	00261
SACU STAT HV ON	ON		00086	TWT BODY CURRENT	5.7157	MAMP	00069
INPUT CURRENT	6.1599	AMPS	00154	ION PUMP CURRENT	-.0598	UAMP	00001
TWT COLLCTR TEMP	16.271	DEGC	00090	HVPS INPUT CURR	2.4312	AMPS	00289
DFB#1 TEMP	25.790	DEGC	00118	TRANSMIT POWER	101.27	WATT	00339
MTU TEMPERATURE	5.2156	DEGC	00059	SMMR			
TRANSMIT POWER	1.5669	KW	00497	INPUT CURRENT	2.5699	AMPS	00128
SAR				SCAN MTR CURRENT	-1.449	VOLT	00058
SAR CURRENT	.99999	AMP	00005	DATA SYS STATUS	ON		00001
SDL CURRENT	.04000	AMP	00001	VIRR			
SDL XMTR TEMP	-133.4	DEGF	00000	DETECTOR TEMP	35.382	DEGF	00045
SAR STBY PWR	ON		00014	MOTOR ROTATION	ON		00159
SED TIMER A	OFF		00153	ELEC CKT I/P PWR	ON		00171
SED TIMER B	OFF		00000	HOUSING TEMP A	35.145	DEGF	00046

QUICKLOOK PAGE 2

```
ORB:00000   SYS: C07   PTCH:-.94400   SUN:NO              CMD ACC:178   GMT-122:17:48:14
PRI: PB     QUAL:GOOD  ROLL:.775997   BUS VLT:27.50       CMD EXC:152   SCI-001:02:05:11
SRCE:TAPE              YAW:  N.A.     PIE:N.A. N.A.       MEM:ENABLE    FRAME LOCK:00992

PAGE 15          QUICKLOOK PAGE 2   SCATTEROMETER SYSTEM STATUS
```

INPUT CURRENT	2.7199	AMPS	00034	MODE 8	NSEL		00191
+28 VOLTS REG PS	28.114	VOLT	00149	MODE 9	SEL		00000
TWT CATHODE VOLT	-8.023	KV	00251	STANDBY	SEL		00000
TWT CATHODE CURR	56.060	MAMP	00164	DC/DC CON#3 STAT	ON		00216
TWT BODY CURRENT	5.7157	MAMP	00069	DC/DC CON#4 STAT	OFF		00216
ION PUMP CURRENT	-.0598	UAMP	00001	DC/DC +5V CONV	5.0877	VOLT	00522
HVPS INPUT CURR	2.4312	AMPS	00289	DC/DC +15V CONV	14.970	VOLT	00512
TWT FIL CURRENT	1.4894	AMPS	00375	DC/DC -15V CONV	-14.94	VOLT	00292
MODE 1	NSEL		00191	DC/DC -6V CONV	-5.976	VOLT	00254
MODE 2	SEL		00191	DC/DC +6V CONV	5.9649	VOLT	00510
MODE 3	NSEL		00191	TRANSMIT POWER	101.27	WATT	00339
MODE 4	NSEL		00191	RCVR PROT CKT ST	PROT		00004
MODE 5	NSEL		00191	INPUT CURR TRIP	NTRP		00004
MODE 6	NSEL		00191	UNDERVOLT TRIP	NTRP		00004
MODE 7	NSEL		00191	BODY CURENT TRIP	NTRP		00191

SASS PAGE 1

```
ORB:00000  SYS: C07   PTCH:+.94400  SUN:NO          CMD ACC:178  GMT-122:17:48:25
PRI: PB    QUAL:GOOD  ROLL:.845837  BUS VLT:27.25   CMD EXC:152  SCT-001:02:05:12
SRCE:TAPE             YAW: N.A.     PTE:N.A. N.A.   MEM:ENABLE   FRAME LOCK:01004
PAGE 24                    SASS PAGE 1  STATUS DATA
     MODE 1             NSEL         00191   POLARIZATION       HH          00004
     MODE 2             SEL          00191   LEFT/RIGHT ANT     LEFT        00004
     MODE 3             NSEL         00191   FORE/AFT ANT       FWD         00004
     MODE 4             NSEL         00191   LO PHASE LOCK LP   LOCK        00000
     MODE 5             NSEL         00191   XMIT PHASE LOCK    LOCK        00000
     MODE 6             NSEL         00191   BODY CURR TRIP     NTRP        00191
     MODE 7             NSEL         00191   INPUT CURR TRIP    NTRP        00004
     MODE 8             NSEL         00191   UNDERVOLT TRIP     NTRP        00004
     MODE 9             SEL          00000   RCVR PROT CKT ST   PROT        00004
     MODE 10            STBY         00000
     CALIBRATE STATUS   NCAL         00004
     NOISE DIODE STAT   OFF          00191
     HIGH FREQ SELECT   HIGH         00000
     LOW FREQ SELECT    LOW          00512
```

SASS PAGE 2

```
ORB:00000  SYS: C07    PTCH:-.95200  SUN:NO            CMD ACC:178  GMT-122:18:02:38
PRI: PB    QUAL:GOOD   ROLL:.605278  BUS VLT:27.50     CMD EXC:152  SCT-001:02:05:10
SRCE:TAPE              YAW:  N.A.    PTE:N.A. N.A.     MEM:ENABLE   FRAME LOCK:02200
PAGE 25                   SASS PAGE 2  ANALOG ENGINEERING
    CALIBRATE STATUS   NCAL             00904    DC/DC +5V CONV       5.0682   VOLT 00520
    STANDBY            SEL              00000    DC/DC +15V CONV      14.970   VOLT 00512
    TWT CATHODE VOLT   -8.022   KV      00259    DC/DC -15V CONV      -14.94   VOLT 00292
    TWT CATHODE CURR   55.702   MAMP    00163    DC/DC -6V CONV       -5.952   VOLT 00253
    TWT BODY CURRENT   5.7999   MAMP    00070    DC/DC +6V CONV       5.9649   VOLT 00510
    ION PUMP CURRENT   -.0598   UAMP    00001    UP CONV BIAS         .10040   VOLT 00214
    HVPS INPUT CURR    2.4412   AMPS    00290    TDA STAGE 1 BIAS     .14451   VOLT 00368
    TWT FIL CURRENT    1.4945   AMPS    00376    TDA STAGE 2 BIAS     .15952   VOLT 00340
    TRANSMIT POWER     101.27   WATT    00339    TDA STAGE 3 BIAS     .16750   VOLT 00357
    LOCAL OSC POWER    11.574   DBM     00358    THERMISTOR REF 1     5.1073   VOLT 00522
    MODULATOR POWER    21.144   DBM     00400    THERMISTOR REF 2     5.0976   VOLT 00521
    XMIT DRIVE         17.232   DBM     00391
```

SASS PAGE 3

```
ORG:00000   SYS: C07    PTCH:-.95200   SUN:NO             CMD ACC:178   GMT-122:17:57:21
PKT: PB -   QUAL:GOOD   ROLL:.605278   BUS VLT:27.50      CMD EXC:152   SCT-001:02:05:10
SRCE:TAPE               YAW:  N.A.     PTE:N.A. N.A.      MEM:ENABLE    FRAME LOCK:01756
PAGE 26                           SASS PAGE 3  TEMPERATURES
     CALIBRATE STATUS   NCAL              00904      FIRST MIXER         6.4117   DEGC 00712
     STANDBY            SEL               00000      SECOND MIXER        17.303   DEGC 00588
     TWT 1              5.2383   DEGC 00692          TDA                 35.486   DEGC 00417
     TWT 2              7.2097   DEGC 00690          XTAL FILTER P1      25.498   DEGC 00492
     TWT 3              9.7691   DEGC 00665          XTAL FILTER P6      21.011*  DEGC 00549
     OUTPUT ISO         5.6844   DEGC 00719          XTAL FILTER P10     26.181   DEGC 00495
     HVPS               6.1009*  DEGC 00715          XTAL FILTER P12     24.155   DEGC 00516
     ASM                .76741   DEGC 00736          BASEPLATE 1         4.7389   DEGC 00728
     SSS/LO             4.4613   DEGC 00699          BASEPLATE 2         4.2385   DEGC 00701
     UP-CONVERTER       4.4209   DEGC 00731          BASEPLATE 3         4.4233   DEGC 00731
     A/D CONVERTER      20.477   DEGC 00544          BASEPLATE 4         7.3370   DEGC 00703
     NOISE SOURCE       1.4918   DEGC 00758          BASEPLATE 5         3.6795*  DEGC 00706
     DIR_DETECTOR       3.4552   DEGC 00708          BASEPLATE 6         5.0554   DEGC 00725
     SASS BP TEMP#1     37.124   DEGF 00184          SASS BP TEMP#2      42.719   DEGF 00179
```

Limit $14^{o}F$ to $131^{o}F$
$-10^{o}C$ to $55^{o}C$

SASS PAGE 4

```
ORB:00000  SYS: C07   PTCH:-.95200  SUN:NO          CMD ACC:178  GMT-122:17:57:28
PRI: PB    QUAL:GOOD  ROLL:.605278  BUS VLT:27.50   CMD EXC:152  SCI-001:02:05:10
SRCE:TAPE             YAW:  N.A.    PTE:N.A. N.A.   MEM:ENABLE   FRAME LOCK:01764
PAGE 27                      SASS PAGE 4  SCIENCE DATA
    MODE 1            NSEL        00191   POLARIZATION      HH             00904
    MODE 2            SEL         00191   LEFT/RIGHT ANT    RITE           00904
    MODE 3            NSEL        00191   FORE/AFT ANT      AFT            00904
    MODE 4            NSEL        00191   GAIN CHANNEL #1   G2             00512
    MODE 5            NSEL        00191   GAIN CHANNEL #12  G1             00000
    MODE 6            NSEL        00191   GAIN CHANNEL #15  G1             00000
    MODE 7            NSEL        00191   SIG+NOISE CH #1   .48875  VOLT   00050
    MODE 8            NSEL        00191   SIG+NOISE CH #12  1.1730  VOLT   00120
    MODE 9            SEL         00000   SIG+NOISE CH #15  3.9882  VOLT   00408
    MODE 10           STBY        00000   NOISE ONLY CH#1   .64516  VOLT   00066
    CALIBRATE STATUS  NCAL        00904   NOISE ONLY CH#12  .83089  VOLT   00085
    NOISE DIODE STAT  OFF         00191   NOISE ONLY CH#15  5.6891  VOLT   00582
    HIGH FREQ SELECT  HIGH        00000
    LOW FREQ SELECT   HIGH        00513
```

SASS PAGE 5

```
ORB:00000  SYS: C07    PTCH:-.95200  SUN:NO          CMD ACC:178  GMT-122:17:57:32
PRI: PB    QUAL:GOOD   ROLL:.605278  BUS VLT:27.50   CMD EXC:152  SCT-001:02:05:10
SRCE:TAPE              YAW:  N.A.    PTE:N.A. N.A.   MEM:ENABLE   FRAME LOCK:01772
PAGE 28                    SASS PAGE 5  ALARM PARAMETERS
    ION PUMP CURRENT   -.0598  UAMP 00001
    HVPS INPUT CURR    2.4412  AMPS 00290
    DC/DC +15V CONV    14.970  VOLT 00512
    DC/DC -15V CONV    -14.94  VOLT 00292
    RCVR PROT CKT ST   PROT         00904
    BASEPLATE 4        7.3370  DEGC 00703
```

SNAP 02 SCATTEROMETER SYSTEM ALL DATA SNAPSHOT

MODE 1	NSEL	XMIT PWR	101.2714	SUB COM CNTR	00001610
MODE 2	SEL	TWT CAT V	-8.02239	BP RT 3	4.84455*
MODE 3	NSEL	TWT CTA I	55.70203	BP RT 5	4.238569
MODE 4	NSEL	TWT BODY CURR	5.799926	BP RT 14	4.623369
MODE 5	NSEL	ION PUMP CURR	-.059842	BP RT 7	109.318*
MODE 6	NSLE	HOPS INPUT I	2.441280	BP RT 17	151.665*
MODE 7	NSEL	TWT FIL I	1.494519	BP RT 18	5.055433
MODE 8	NSEL	LO PWR	11.57444	TWT RT 6	5.23832*
MODE 9	SEL	MOD PWR	21.14454	TWT RT 10	7.20976*
MODE 10	STBY	XMIT CH PWR	11.23284	TWT RT 16	9.66786*
CAL STAT	NCAL	UP CON BIAS	.1004086	UP ISO RT 13	5.684478
NOISE DIODE STAT	OFF	TDA 1 BIAS	.1445133	HVPS RT 9	109.318*
POL	HH	TDA 2 BIAS	.1595277	ASH RT 12	151.665*
L/R ANT	RIGHT	TDA 3 BIAS	.1675041	SSS/LO RT1	4.35078*
F/A ANT	AFT	DC CONV V+15	5.068267	UP CONV RT2	4.42097*
LO FREQ SEL	HI	DC CONV V+15	14.97048	A/D CONV TEMP	20.47760
HI FREQ SEL	HI	DC CONV V-15	-14.9485	NOISE SOUR RT15	1.491897
LO LOOP STAT	LOCK	DC CONV V-6	-5.95292	DIR DET RT 11	3.455230
XMIT LOOP STAT	LOCK	DC CONV V+6	5.964902	1 MXR RT 4	6.411772
IN CURR TRIP	NTRIP	THERM REF#1	5.107392	2 MXR TEMP	17.30390
UNDERVOLT TRIP	NTRIP	THERM REF#2	5.097628	TDA RT 8	109.318*
BODY CUR TRIP	NTRIP			XTAL FIL P6 TEMP	151.977*
PRO CIR STAT	PRO			XTAL FIL P1 TEMP	25.49881
				XTAL FIL P10 TEMP	26.18100
				XTAL P12 TEMP	24.15521

GAIN CH 1		ANT1 TEM1	116.419*
SGN CH1	.4887590	ANT1 TEM2	116.419*
N CH1	.6451620	ANT1 TEM3	116.419*
GAIN CH2		ANT1 TEM4	116.419*
SGN CH2	3.910072	ANT1 TEM5	116.419*
N CH2	1.562-0*	ANT1 TEM6	116.419*
GAIN CH3		ANT1 TEM7	116.419*
SGN CH3	3.626592	ANT1 TEM8	116.419*
N CH3	1.562-0*	ANT1 TEM9	116.419*
GAIN CH4		ANT1 TEM10	116.419*
SGN CH4	3.460414	ANT2 TEM1	116.419*
N CH4	1.562-0*	ANT2 TEM2	116.419*
GAIN CH5		ANT2 TEM3	116.419*
SGN CH5	3.000980	ANT2 TEM4	116.419*
N CH5	3.196483	ANT2 TEM5	116.419*
GAIN CH6		ANT2 TEM6	116.419*
SGN CH6	2.639299	ANT2 TEM7	116.419*
N CH6	2.629523	ANT2 TEM8	116.419*
GAIN CH7		ANT2 TEM9	116.419*
SGN CH7	2.179865	ANT2 TEM10	116.419*
N CH7	2.033236	ANT3 TEM1	116.419*

GAIN CH8		ANT3 TEM2	116.419*
SEN CH8	1.915934	ANT3 TEM3	116.419*
N CH8	1.642230	ANT3 TEM4	116.419*
GAIN CH9		ANT3 TEM5	116.419*
SEN CH9	1.691105	ANT3 TEM6	116.419*
N CH9	1.397850	ANT3 TEM7	116.419*
GAIN CH10		ANT3 TEM8	116.419*
SEN CH10	1.534703	ANT3 TEM9	116.419*
N SH10	1.055719	ANT3 TEM10	116.419*
GAIN CH11		ANT4 TEM1	116.419*
SEN CH11	1.378300	ANT4 TEM2	116.419*
N CH11	.9481928	ANT4 TEM3	116.419*
GAIN CH12		ANT4 TEM4	116.419*
SEN CH12	1.143695	ANT4 TEM5	116.419*
N CH12	.8015649	ANT4 TEM6	116.419*
GAIN CH13		ANT4 TEM7	116.419*
SEN CH13	4.027374	ANT4 TEM8	116.419*
N CH13	5.659830	ANT4 TEM9	116.419*
GAIN CH14		ANT4 TEM10	116.419*
SEN CH14	3.870971		
N CH14	5.581628		
GAIN CH15			
SEN CH15	3.958948		
N CH15	5.718481		

Operational (Science Data) - The Operational Science Data processing is being handled by LARC and JPL and will not be discussed in this report.

SECTION 7

QUALITY CONTROL

SECTION 7
QUALITY CONTROL

7.1 QUALITY PROGRAM

The Quality Assurance Plan described in document SASS-DRL-Q9 is the quality program performed by General Electric Space Systems in the performance of the SeaSat A Satellite Scatterometer (SASS) contract quality requirements with NASA/LARC. The quality plan meets the intent of NASA Reliability and Quality Assurance Publication, NHB5300.4(1B), "Quality Provisions for Aeronautical and Space Systems Contractors" as amended by Exhibit 5 to the Statement of Work. The Quality Program provided controls that resulted in delivered end-items that met contract requirements as proposed through all phases from design, procurement, manufacturing, integration and test of the SeaSat A Satellite Scatterometer.

7.2 RELIABILITY

The SASS Reliability Program Plan described in PIR-U-1312-JH-171 in the program complied with by GE to meet the Statement of Work requirements for the SASS program.

7.3 PARTS

The parts and materials list was prepared and delivered with the SASS as part of the End-Item Data Package (SASS Historical Logbook).

7.4 NON-CONFORMANCE HISTORY

7.4.1 WAIVERS/DEVIATIONS SUMMARY

Number	Description	Submitted	Approved
001	Roll Swaged Terminals on PWB	12/12/76	3/14/77
002	Shipment of SASS with Eng. Model HVPS	10/07/77	10/12/77
003	72 Hour Burn-In of HVPS Transistors	11/01/77	12/14/77
004	Use of Unscreened Transistors in HVPS	12/06/77	12/14/77
005	Collector #2 Output Voltage of the HVPS	12/12/77	12/14/77

7.4.2 FAILURE ANALYSIS REPORT (F.A.R.) SUMMARY

F.A.R.	Failure Report	Description	Status
1163-SAS-01	NR44381	HVPS #1 - Cathode/Collector Module	Closed Out
1169-SAS-02	NR46881	HVPS #1 - Cathode/Collector Module	Closed Out
1173-SAS-03	001	HVPS #1 - Grid Converter Module	Closed Out
1183-SAS-04	012	Temperature Sensor	Closed Out
1186-SAS-05	013	HVPS #1 - Grid Converter Module	Closed Out
1193-SAS-06	021/022	IEA - PROM Microcircuit	Closed Out
1194-SAS-07	020/023	SSS/LO - Internal Broken Connection	Closed Out

7.4.3 SYSTEM FAILURE SUMMARY

Unit	No. of Failures Requiring Rework	Type Test
HVPS #1	2	a. Initial System Integration b. Thermal Vacuum
IEA	2	a. Initial System Integration b. Post Vibration (X Axis)
SSS/LO	1	Post Vibration (Z Axis)
Thermistor	1	Initial System Integration
Connector	1	Initial System Integration
Connector Pin	1	Q/FA Functional
System Wiring (Drawing Error)	1	Initial System Integration
LNA Heater Elements (Test Error)	1	Initial System Integration

7.4.4 FAILURE CATEGORY SUMMARY

Top Assemblies	Failure Categories: Test Method	Instrumentation	Dwg. Error	Test Reqmt. Change	Design	Workmanship	Defective Part
SASS	-	1	1	6	-	1	1
HVPS #1	-	-	-	-	6	-	-
HVPS #2	-	1	-	1	2	-	-
IEA	-	-	1	-	-	1	2
SSS/LO	-	-	-	1	-	2	-
LNA Temp. Control	1	-	-	-	-	-	-
Sub Assemblies							
PWB, IEA (47D235315)	-	-	-	-	-	1	1
Module, HVPS (47D235110)	-	-	-	-	1	1	-

7.4.5 FAILURE REPORT SUMMARY

Failure Report: 001 to 013, Initial System Integration Testing

014 to 030, Qualification and Flight Acceptance (Q/FA) Testing

031 to 033, HVPS #2 (Flight Unit) Testing

Item	Drawing	Test Level	F/R No. N/R No.	Description of Nonconformance	Summary
SASS	47J235000	System	001 46814	HVPS not responding to the "ON" command.	HVPS module, Grid Modulator (47D235110) defective. Failure due to arcing. Design changes incorporated. Ref. Failure Analysis Report #1173-SASS-03
SASS	47J235000	System	002 46818	R.F. envelopes verified, but very erratic.	A6A1 Board (47D235291) of IEA failed. Failure caused by a defective A21 chip (SNC 54LS174W00). Part replaced. Retest OK. Refer to PIR 1JL6-JH-542.
SASS	47J235000	System	005 47027	LNA Heater Elements (RT1 and RT6) overstressed during LNA heater check.	Test method error. Test modified in SI 250046. RT1 and RT6 replaced.
SASS	47J235000	System	006 46825	IEA Data Update out-of-spec	Intermittent connection at connector of A6 module of IEA. All connections reinspected and torqued. Retest OK. Ref. PIR U-1J40-JH-547 and U-1B40-JH-557.
SASS	47J235000	System	010 47031	XMIT power TLM reads zero.	Unit wired incorrectly due to drawing error. Drawing corrected. Unit reworked and retested OK. Ref. AN's 47A235001-3 and 47J235020-4. Also Ref. PIR 1JL6-JH-555.
SASS	47J235000	System	012 47036	Output isolator temperature TLM measures zero on data stream. Spec is 477 to 557 counts.	Thermistor RT13 found to be shorted. Ref. F/A #1183-SAS-04. After rework, retest OK.
SASS	47J235000	System	014 47038	Multiple out-of-spec readings.	Test procedure changed. In all cases all data in spec.
SASS	47J235000	System	015 47039	Power measurement was out of spec (LOW).	Caused by improper test-setup; after correcting problem power measured in spec.
SASS	47J235000	System	016 47052	Multiple out-of-spec conditions on TLM temperature channels	Test procedure changed. In all cases all data in spec.
SASS	47J235000	System	017 46496	Multiple out-of-spec readings.	Test procedure changed. In all cases all data in spec.
SASS	47J235000	System	018 46497	Out-of-spec power measurements.	Test procedure changed. In all cases all data in spec.
SASS	47J235000	System	019 46498	Intermittent indication of output isolator temperature TLM.	Problem due to defective connector socket on Pin 65 of A8J2 of IEA. Pin replaced and retest was OK.
SASS	47J235000	System	020/023 46499 47111	Failure in SSS/LO (47D235460) during post vibration (Z axis) confidence test.	Caused by internal broken connection. Ref. to F/A #1194-SAS-07 after rework unit retested OK.
SASS	47J235000	System	021/022 46500 47110	No output data from IEA (47E235250) during post vibration (X axis) confidence test.	Caused by internal contamination in microcircuit A8 (R9282P29) on the A2A6 P.W.B. in IEA. Ref. F/A #1193-SAS-06. After replacement of defective part IEA tested OK.

ORIGINAL PAGE IS OF POOR QUALITY

Item	Drawing	Test Level	F/R No. N/R No.	Description of Nonconformance	Summary
SSS/LO	47D235460	Component	008 46829	Multiple out-of-spec conditions measured at vendor prior to delivery to GE.	All items accepted by change to specification. Ref. AN SVS-8890-4 and 47D235460-3.
SSS/LO	47D235460	Component	024 46830	SSS/LO failed post vibration test (unit was being retested after rework for F/R #023). The transmitter power monitor began to vascillate at approximately 10 minutes into the test, also AN indication of phase lock loss was noted.	Caused by defective board assembly and inadequate burn-in of RF cavity which was replaced previously. Ref. to vendor corrective action letter L/N 282 after burn-in and replacement of board unit tested OK.
Module (HVPS)	47D235110	Subassembly Module	013 47049	Grid Modulator failed insulation resistance post pot test.	Caused by potting compound adhesion internal to module. Ref. F/A #1186-SAS-05. Part scrapped after analysis.
Module (HVPS)	47D235110	Subassembly Module	003 46817	E_{29} output out-of-spec and could not be adjusted with decade box.	Resistor R9 of Grid Modulator Board A1 (47D235118) found to be open. Open resistor caused by operator during removal of sleeving. Manufacturing planning modified to inspect resistor after removal of sleeving.
PWB (IEA)	47D235315	Subassembly (PWB)	009 47029	No output at Channel A. Channel "B" cannot be adjusted.	Cause: CR5 defective - damaged by prior removal during troubleshooting. Unit reworked; retested OK.
PWB (IEA)	47D235315	Subassembly (PWB)	011 47035	Channel "B" output intermittent.	Caused by defective pulse transformer (U16, R9654P1). Part replaced and retested OK.

Item	Drawing	Test Level	F/R No. N/R No.	Description of Nonconformance	Summary
SASS	47J235000	System	028 47136	Multiple out-of-spec readings on temp. TLM during thermal vacuum environment.	Test procedure changed. All data now in spec.
SASS	47J235000	System	029 47137	During thermal vacuum test, several GSE power supply trip outs while attempting to enable the HVPS.	Caused by excessive inrush current. HVPS design change in booster circuit per AN's 47E235100-12 and 47A235151-5. Retested satisfactorily.
SASS	47J235000	System	030 47121	Out-of-spec temperature TLM for Pi filter and A/D converter.	Test procedure changed. All data now in spec.
HVPS #1	47E235100	Component	004 46824	Ion Pump current TLM voltage out-of-spec	Excessive noise in ion pump (PWB 47D235103) TLM circuitry. Reworked to AN 47D235103-8 (capacitor added). Retest OK.
HVPS #1	47E235100	Component	007 47028	Q1 and Q2 failed during thermal vacuum test of HVPS.	Caused by minor looping. Design changes incorporated. (AN's 47D235124-2, 47D235219-2 and 47 47D235104-4). Ref. PIR U-1M20-JH-577.
HVPS #1	47E235100	Component	025 47133	Filament current TLM indicated excessive drift during ambient test of HVPS.	Caused by variations in switching speed in transistors Q1 and Q2 on A2 board (47D235102). Q1 and Q2 changed to 2N1983. Refer to AN 47D235102-2 and PIR-1M20JH-577.
HVPS #1	47E235100	Component	026 47134	Minor looping noted during ambient testing of HVPS.	Caused by inadequate design in the boost transistor circuit. Design changes implemented. Refer to AN's 47D235124-2, 47D235219-2 and 47D235104-4. After rework unit retested OK.
HVPS #1	47E235100	Component	027 47135	During special test at high temp., fluid from the high voltage test probe flowed onto terminal block no. 1 (external to HVPS).	Terminal block replaced; retest OK.
HVPS #2	47E235100	Component	031 47155	Unable to adjust filament current and voltage to 1.55A and -3.18 KV.	Q1 and Q2 (JTX2N1893) on A2 board, 47D235102, not switching properly. (V_{CE} Sat. too high) Installed unscreened JAN2N1893 transistors. Retested OK. Waiver Request (004) for use of unscreened transistors, approved 12/14/77.
HVPS #2	47E235100	Component	032 47156	1) collector #2 (E_{b2}) voltage out-of-spec. 2) ion pump current telemetry out-of-spec. 3) cathode voltage(E_K) out-of-spec.	1) waiver request 005 approved 12/14/77. 2) test procedure changed per SIR #250048-1; data in spec. 3) reselected select resistors; data in spec.
HVPS #2	47E235100	Component	033 47159	Grid voltage E_{gK} out-of-spec by 100 volts during thermal vacuum environment (at +55°C).	- Caused by arcing due to bursts of outgassing during thermal vacuum - Arc caused the 116 module of the grid modulator (47D235110) to fail. Corrective Action: - Potted entire TB-1 terminal block on the HVPS. - Cleaned T/V chamber. - Installed ion gauges in chamber. - Installed witness mirrors in chamber. - Potted internal H.V. terminals of T/V penetration plate. - Operated with cold chamber walls. - Replaced failed 116 module. - Updated SI where applicable. - Retested OK.

SECTION 8

DOCUMENTATION SUMMARY

SECTION 8

DOCUMENTATION SUMMARY

8.1 SYSTEM LEVEL TEST DOCUMENTATION

The following documents were used in the SASS system evaluation troubleshooting and acceptance testing:

Document	Title
SI 250046	Qualification/Flight Acceptance Test Procedure
TR-SASS-005	Check IEA after A6A1 PWB Repair
TR 01	Preliminary Evaluation of A21/A10 LNA Thermal Control
TR 02	Inrush Current Evaluation
TR 03	Evaluate FLT SSS/LO Performance in the SASS Instrument
TR 04	Evaluate Receiver Balance with Fore and Aft Local Oscillators
TR 05	Evaluate SSS/LO Telemetry
	Test Outline
TR 06	Inrush Current Evaluation (TR 02)
	HVPS Turn-On (XMIT Inhibit ON)
	HVPS Performance/Quick Look
	TR 07, TR 08, TLM Data Evaluation and LNA Heater Test
TR 07	ASM Isolation
TR 08	Receiver Calibration
TR 09	Obtain statistical information on SASS Receiver with Normal Waveguide Termination and with a Cryogenic Load
TR 10 A & B	Evaluation of transients associated with the HVPS/TWT when operated with the STC/RSS
TR 11	Calibration of W/G test manifold under high power operating conditions
TR 12	Engineering functional test after SASS has been configured for vibration
TR 13	Troubleshoot NR 46499 (Post Z-Axis vibration)
	Anomalies: 1) XMIT Lock Loss indicated
	2) XMIT PWR TLM Low
	3) Upconverter Bias Low
TR-SASS-14	Troubleshoot NR 46500
	Anomaly: 1) No indication of an output data stream
TR-SASS-15	Verification of anomalies noted in NR 46499
TR-SASS-16	Confidence Test after replacing IEA A6A1 Board. Ref. F.R. #021 (NR 46500).

Document	Test Outline (cont'd)
TR-SASS-17	Confidence Test with SSS/LO Breadboard. R f. F. R. #020 (NR 46499).
TR-SASS-18	Bonding Resistance Measurements
TR-SASS-19	Functional Test after Rework of HVPS, IEA and SSS/LO in preparation for Thermal Vacuum Test
TR-SASS-20	Confidence Test prior to Thermal Vacuum Pump-Down
TR-SASS-21	Troubleshooting, Crowbar Trip Problem associated with HVPS Enable
TR-SASS-22	Continuation of TR21 in Temperature Chamber Only (not Thermal Vacuum).
TR-SASS-23	Temperature Test after Rework of HVPS (Crowbar Trip Problem)

Note: TR-SASS-24 and TR-SASS-25 were tests conducted on the flight HVPS and QM TWT only.

8.2 SYSTEM LEVEL MAGNETIC TAPES

Below is a list of magnetic tapes made during SASS System Level Testing.

TEST DESCRIPTION	DATE	ORIGINAL TAPE #	ASSIGNED TAPE #	CDT #
Bench Test - Cryogenic Load	8/9/77	408	EX861	01217
Pre. Env. Systems Test Para. 4.2.3.2 - 4.3.14.14.A (SI-250046)	8/25/77	377	None	None
Pre. Env. System Test Para. 4.4.1 - 4.4.1.3	8/27/77	10272D	None	None
Pre. Env. Para. 4.4.1.3.4	8/28/77	10285D	None	None
Pre. Env. Rec. Dynamic Range Para. 4.4.1.3.5	8/28/77	10288D	EX502	17366
Duped 9 TRK Tape of the Above	8/28/77	10288D	20526	02838
Pre. Env. Para. 4.4.1.4 - 4.4.1.1.19	8/29/77	10289D	None	None
Pre. Env. Para. 4.4.3.3 - 4.4.3.3.5 (Rec. Baseline & Dynamic Range)	8/29/77	10271D	None	None
Pre. Env. Para. 4.4.3.4.1 to 4.4.2.3.6.G	8/30/77	10270D	None	None
Pre. Vib. Confidence	9/2/77	3308	None	None
Vib. After Z Axis Troubleshooting per TR #13	9/3/77	3429	None	None
Pre. T.V. Confidence (TR 20) and Room Amb. at Vacuum (Test #1)	9/28/77	4227	04227	11425
Note: The above tape was of poor quality and the CDT contained only the first 150 records. A duped tape was made from which a good CDT was made.				
Duped tape of the above	9/28/77	04227	07157	15563
T. V. Test #1 - XMIT Pulse Shape to Para. 5.3.2.1.P	9/29/77	04184	04184	None

TEST DESCRIPTION	DATE	ORIGINAL TAPE #	ASSIGNED TAPE #	CDT #
Duped Tape of the above	9/29/77	04184	03021	10504
T. V. Test #2 ($0^{o}C$) from 272:17:59:00 to 273:04:37:15	9/29/77 9/30/77	01982 (3 files)	01982	03707 (File 2 only) (Conf. Test)
T. V. Test #2 ($0^{o}C$) from 273:04:56:30 to 273:10:16:30	9/30/77	01831 (3 files)	01831	22509 (File 3 only- Dynamic Range)
T. V. Test #3 ($-10^{o}C$)	9/30/77	02773	02773	17402
T. V. Test #4 ($35^{o}C$)	10/1/77	02261 (6 files)	02261	15346 (File 5 only Dynamic Range)
T. V. Test #5 ($55^{o}C$) - File 1	10/1/77	02816	02816	18659 (File 1)
T. V. Test #6 ($0^{o}C$) - File 2	10/1/77	02816	02816	22366 (File 3)
T. V. Test ~~#7~~ ($35^{o}C$) - File 3	10/1/77	02816	02816	
T. V. Test #8 ($0^{o}C$) - File 1	10/2/77	02775	02775	None
T. V. Test Transition - File 2	10/2/77	02775	02775	None
T. V. Test #9 ($35^{o}C$) - File 3	10/2/77	02775	02775	None
T. V. Test #10 ($55^{o}C$) File 1	10/3/77	732-1	EX078	None
T. V. Test #11 ($-10^{o}C$) File 2	10/4/77	732-1	EX078	None
T. V. Test Transition File 3		732-1	EX078	None
T. V. Test #12 ($0^{o}C$) File 4		732-1	EX078	None
T. V. Test Transition to $35^{o}C$ - File 5		732-1	EX078	None
T. V. Test #13 ($35^{o}C$) File 6		732-1	EX078	None
T. V. Test #14 (Amb.) File 7		732-1	EX078	None
T. V. Instrument Calibration	10/4/77	732-2	EX077	
Para. 6.1.XXX (File 1)	10/5/77	732-2	EX077	19565
Para. 6.4.XXX (File 2)		732-2	EX077	16928
Para. 6.2.XXX (File 3)		732-2	EX077	16633
Para. 6.3.1 - 6.3.4 (File 4)		732-2	EX077	16879
Para. 6.3.5 (File 5)		732-2	EX077	15015
(Dynamic Range) (File 6)		732-2	EX077	13979
TR023 Confidence	10/8/77	18468	None	None
File 1 = $0^{o}C$	10/8/77	18468	None	None
File 2 = $25^{o}C$	10/8/77	18468	None	None
Receiver Test @ LMSC with modified Return Pulse	11/9/77	17183	17183	04179 (File 3) 08045 (File 4)
Duped Tape of the above	11/9/77	18183	14620	Same as above
Note: Original of above tape was sent to Langley.				
Confidence Test after HVPS Switchout	12/21/77	60835	EX144	05142 (File 3)